The Late Palaeo-Indian Great Lakes

Geological and Archaeological Investigations of Late Pleistocene and Early Holocene Environments

Edited by Lawrence J. Jackson
& Andrew Hinshelwood

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EDITED BY
Lawrence J. Jackson and
Andrew Hinshelwood

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Left: Holcombe Point, Southwestern Ontario, 5 cm. Photo courtesy J.V. Wright. *Right*: Lanceolate Point, Biloski Site, 8.5 cm. Photo by Andrew Hinshelwood. *Map: Partie occidentale du Canada, contenant les cinq Grands Lacs, avec les pays circonvoisins* 1787. By Rigobert Bonne. Collections of *La Bibliotèque nationale du Québec*.

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LAWRENCE E. JACKSON (right) with Gord Dibb on water break
during the 1979 Lake Algonquin Shoreline Survey near Udora, Ontario.

This volume is affectionately dedicated to the cheerful memory of Lawrence Edward Jackson, amateur archaeologist, tradesman, and father. Lawrence's lifelong passion for archaeology led him to visit sites from Canada to Mexico and to imbue his children with an appreciation of human history. His contributions to Palaeo-Indian studies in Ontario include his participation in the surveys which led to the discovery of the Udora site complex, the co-discovery of the Halstead Gainey phase site, the initial testing of the Halstead and Sandy Ridge Gainey phase sites on Rice Lake (which led to their excavation and publication), and survey work for Late Palaeo-Indian sites in Plainville Valley south of Rice Lake, Ontario. All those that he worked with, especially his wife Anne, and his three children Lawrence, Kevin and Debora, will miss his enthusiasm, kindness, and sense of humour.

Abstract

This volume of 13 articles dealing with Late Palaeo-Indian archaeological sites and environments in the Great Lakes region offers a detailed overview of this little understood-time period. The nature of glacial recession throughout this region, with dramatic differences between contiguous areas, created a highly complex set of environments to challenge human adaptive ability. Although our understanding of Late Palaeo-Indian peoples and their lives is sketchy at best, the assembled papers provide both intensive looks at individual sites, and broad overviews, which will aid our understanding of cultures in transition.

The contributions included in this volume cover both cultural and historical aspects of this critical time in the Great Lakes region, as well as issues dealing with the dynamic nature of the landscape. Questions of cultural classification and typology are explored for various parts of both northern and southern Ontario. Other papers address the evolving nature of the environmental contexts within which these early human societies were adapting, and the interrelationship between landscape and people from the lower to the upper Great Lakes.

Overall, the assembled papers provide a wealth of information which will aid research into this unique time period. The editors hope that the next few years will see a similar compilation of papers for the American side of the Great Lakes.

Résumé

Ce volume contient 13 articles qui traitent de sites archéologiques et d'environnements du Paléoindien supérieur situés dans la région des Grands Lacs. Ces articles donnent une vue d'ensemble détaillée de cette période très peu connue. Le retrait glaciaire, qui a affecté toute cette région, a laissé des traces très différentes dans des secteurs contigus. Ainsi, un ensemble extrêmement complexe de milieux de vie est apparu, mettant à l'épreuve les capacités d'adaptation des êtres humains. Bien que notre compréhension de la vie des Paléoindiens supérieurs soit pour le moins superficielle, cette compilation d'articles offre à la fois un examen approfondi de sites particuliers et des vues d'ensemble plus larges qui enrichiront la connaissance que nous avons de cultures en transition.

Les articles compris dans cet ouvrage traitent à la fois des aspects culturels et historiques de cette période critique, dans la région des Grands Lacs, ainsi que de questions relatives à la dynamique des paysages. Certains documents explorent la classification culturelle et la typologie dans différentes parties du Nord et du Sud de l'Ontario. D'autres se penchent sur la nature évolutive des contextes environnementaux dans lesquels ces anciennes sociétés humaines s'inscrivaient, et sur la corrélation entre les paysages terrestres et les peuples depuis le secteur des Grands Lacs inférieurs jusqu'au secteur supérieur des Grands Lacs.

Dans l'ensemble, les documents rassemblés fournissent une abondance de renseignements sur cette période unique qui aideront les chercheurs. Les responsables de la publication espèrent qu'au cours des prochaines années, des articles semblables seront réunis pour décrire la région américaine des Grands Lacs.

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Introduction

This edited volume assembles a series of topical reports on Late Palaeo-Indian and Early Archaic period sites and regional cultural developments in the Great Lakes region for the period circa 10,500 to 8,500 B.P. This time frame is generally considered to be post-glacial; however, the collected papers, including both geological and archaeological studies, make it clear that it was a time of immense environmental adjustment. Research reveals new environmental parameters during this period, as the ice sheets gradually retreated northward (with localized lobal advances and retreats); glacial lakes expanded, contracted, and discharged through new outlets; climate warmed; and forest cover evolved.

Human response to these emerging landscapes is undoubtedly complex, and we still lack some important information that would help us define the origins of Late Palaeo-Indian cultures and determine whether or not they are direct descendants of the better-known Early Palaeo-Indian fluted point-using peoples of the Great Lakes region. For the most part, Late Palaeo-Indian occupation sites from the Upper Great Lakes are distinguished by the use of unfluted, parallel-flaked, lanceolate projectile points. Isostatic rebound along the north shores of Lakes Superior and Huron has saved many strandline situated sites of this time period from flooding, as Great Lakes levels rose through the Holocene period. The early work conducted in Northern Ontario, by Emerson Greenman at George Lake (Greenman and Stanley 1943), Richard MacNeish at the Brohm site (MacNeish 1952), and Thomas Lee at the Sheguiandah quarry site (Lee 1957), documents a rich Late Palaeo-Indian occupation of the north shore. George Quimby later designated this occupation as the "Aqua-Plano" culture (Quimby 1960). By contrast, in southern Ontario, inundation of former lake margin areas covering thousands of square kilometres has drowned many sites of the Late Palaeo-Indian and Early Archaic periods. What survives predominantly, is evidence of ephemeral interior occupations, as in Plainville Valley in the Rice Lake region of south-central Ontario (Jackson *et al.* 2000).

This volume begins with a series of papers on the lower Great Lakes, all bordering southern Ontario, and details some of the problems and obstacles to interpretation of the Late Palaeo-Indian and Early Archaic period. Paul Karrow's paper introduces some of the geological events associated with major environmental change in the period circa 10,500 to 8,500 B.P. Karrow compares and contrasts two Ontario river valleys and suggests some geological associations which rendered them, individually, both attractive and unattractive to human occupation. Lawrence Jackson's paper summarizes available evidence for Late Palaeo-Indian occupation in southern Ontario and extrapolates what may be missing from the archaeological record due to shoreline inundation. He establishes the presence of most known Late Palaeo-Indian point types in the southern part of the province and offers a regional case study from survey of a single interior stream valley. His analysis provides fresh views related to a Late Palaeo-Indian time scale and divergent northern and southern Ontario Late Palaeo-

Indian groups. Chris Ellis's paper on Hi-Lo looks at this Late Palaeo-Indian complex in a Great Lakes context. Through detailed examination of the Hi-Lo tool kit and estimation of the probable age of the culture, mainly by typological comparisons, he makes a strong case for the continuity of Hi-Lo with Early Palaeo-Indian and its distinctiveness from the Early Archaic developments which followed. Andrew Stewart offers a detailed regional study of Late Palaeo-Indian and Archaic finds in the Holland Marsh area of southern Ontario. In his paper, he establishes some of the probable environmental parameters of Late Palaeo-Indian occupation (including a distinctive Hell Gap component at the Zander site), spanning the transition from a Pleistocene Lake Algonquin embayment to a Holocene marshland. Cultural comparisons with the Caribou Inuit on the Kazan River in the Northwest Territories fuel intriguing speculation about the nature of Palaeo-Indian subsistence and site locational choices. Gordon Dibb discusses his detailed survey and Deavitt site excavations in the Simcoe Lowlands of central Ontario, which are also associated with relict Lake Algonquin strandlines. Environmental reconstruction is provided using palynological data obtained by John McAndrews from the Rose Swamp nearby to the Deavitt site. Dibb's paper focuses on definition of the Madina Phase of Late Palaeo-Indian culture. Phillip Woodley follows with a description of fine scale excavations at the Fowler site, a Late Palaeo-Indian Holcombe camp, also located along the Algonquin strandline. Holcombe sites are rarely discovered anywhere in the Great Lakes region. Woodley's evidence for a Holcombe camp and associated tool kits is tied to speculation on reasons for strandline occupation and the probable age of this poorly known culture. Moving away from interior studies of Algonquin embayments, the paper by James Pengelly and Keith Tinkler offers some fascinating insights into the history of human occupation along the Lake Erie basin, including the significant effects of some catastrophic flooding events. The record of Late Palaeo-Indian and Early Archaic finds along this major Great Lake is discussed, as well as some possible ecologically-based reasons for site abundance or absence.

The second section of this volume focuses on the complex post-Pleistocene geological and archaeological sequences of northern Ontario. It begins with a paper by Andrew Hinshelwood, which redefines the Lake Superior 'Lakehead Complex' and draws our attention to some skewed archaeological perceptions based on surface-collected, and even excavated, assemblages. Hinshelwood argues that the presence of clearly-defined beach ridges in areas such as Thunder Bay, Ontario, coupled with abundant lithic raw material, diverts the focus of archaeologists away from the data collection required to tie the archaeological material to the landscape features, in both temporal and functional terms. The argument continues by asserting that the definition of the Lakehead Complex must be tightened to constrain its application, noting that ancient beach ridges also hold attraction for later peoples for quite different reasons than association with an active lake and its resources. John Anderton, Robert Regis and James Paquette offer an integrated archaeological and geological study of Late Palaeo-Indian occupations in the North-Central Upper Peninsula of Michigan. Brian Phillips and Christopher Hill present a highly detailed geological discussion of the "Interlakes Composite" along the northwest shore of Lake Superior and establish a solid groundwork for the dating of human occupations in the region. Significantly, they conclude that this borderland region could have been occupied before the Marquette Readvance circa

10,000 B.P., and possibly as early as 11,000 B.P. Phillips and Hill present an intriguing case for distinctive Late Palaeo-Indian occupations of landscapes newly emerged from Greatlakean and subsequent Marquette Readvance ice, and they use the northwest side of Lake Superior as an example. Research reveals that Agate Basin, Hell Gap, and Cody/Scottsbluff/Eden point-using peoples appear to have lived within 10 to 15 km of actual ice fronts. The problems of Late Palaeo-Indian archaeology in southern Ontario are drawn tightly into focus by Scarlett Janusas, Steve Blasco, Stan McClellan and Jessica Lusted, who discuss their underwater investigations of glacial lake drainage across the submerged Niagara Escarpment north of Tobermory. Their initial finds are tantalizing and are suggestive of future investigations for this region, the results of which will serve to geologically bridge the regions of southern and northern Ontario.

Moving from there to the interior of Northern Ontario, well away from the Great Lakes basins, the final two papers address Late Palaeo-Indian/Early Archaic occupations in more recently deglaciated environments. Jean-Luc Pilon and Luke Dalla Bona describe the early peopling of northwestern Ontario, based on excavations at the Allen site in Sioux Lookout District. As a stratified site with multiple occupations going back 8,100 years, the Allen site is unique in this region and draws attention to previously unsuspected early use of newly deglaciated interior regions. Scott Hamilton concludes the volume with a paper on early Holocene human burials discovered at the Wapekeka airstrip along the Fawn River. Dated to about 7,000 B.P., the site is the second oldest human burial site in northwestern Ontario north of Lake Superior and further documents early penetration of the Hudson Bay Lowlands following deglaciation. Isotopic studies provide some fascinating detail on the possible diet of these early northern people. Hamilton concludes that Lakehead Complex hunters and gatherers entering the Hudsons Bay Lowland are a much more likely progenitor for Early Archaic groups than the ubiquitous Shield Archaic parent culture proposed three decades ago (Wright 1972).

Students of Late Palaeo-Indian studies in the Great Lakes Region will note some omissions among the reports collected in the present volume. The Sheguiandah site, first reported and investigated by Thomas Lee in the 1950's, has a relatively fabled history within the Great Lakes archaeological literature. Early reports of the site presented evidence that some portions had been deposited during the interglacial period, and a number of artifacts appeared to be 'in situ' beneath glacial till deposits. This would have dated the occupation among the earliest in North America. Recent interdisciplinary studies at the site have been published in this series (Julig 2002) and are not considered additionally within this volume.

Few absolute dates are available for Late Palaeo-Indian occupations in the Great Lakes region. However, the stratigraphic succession of similar cultures at other dated North American sites (particularly in the Great Plains area) does document that unfluted lanceolates temporally succeeded fluted points at the very end of the Pleistocene period, and that they persisted for nearly two millennia. The culture and point type names Agate Basin, Hell Gap, Eden, and Scottsbluff, among others, are identified with a series of distinctive lithic hunting cultures. These were distributed across the Plains, sweeping through the Upper Great Lakes region, and eventually reaching into the Lower Great Lakes, north into the Canadian Prairies and into southern parts of the Northwest Territories. Part of the fascination of the Late

Palaeo-Indian period is that it is known geologically as a period of staggering environmental change. Thousands of square kilometres of glacial lakes drained, glacial lobes surged and retreated, new discharge outlets opened, the climate became warmer and drier, and Early Palaeo-Indian open spruce parklands were replaced with more closed pine forests throughout much of the Great Lakes region. The challenges to human survival at this time were enormous, as were the opportunities, and these undoubtedly resulted in some unique cultural patterns, which we are only now beginning to recognize. If the evidence of dating provided by the authors in this volume is any indication, the rate at which these early material cultures spread across the vast North American landscape was incredibly fast. At the northern margins of the habitable landscape, amidst a complex post-Pleistocene mosaic of lakes, moving water, ice and till, a northern Palaeo-Indian tradition appears to have emerged – distinct in some respects from the better-known lanceolate traditions of the Plains. In addition to Great Lakes basin flooding, which has obscured the archaeological record, many areas of northern and northwestern Ontario had fluctuating availability to human occupants because of lobal readvances and associated flooding. As noted by some of the authors in this volume, the deposition of till moraine deposits could even occur over frozen sediments that eventually melted and collapsed, removing any evidence of early occupation. It is of little wonder then, that the archaeological record for this period is both confusing and sporadic. It is not yet complete enough to give us a clear idea of how early populations interacted with highly active local post-glacial environments. Hopefully, this volume will serve to supply some of the missing details and assist future researchers in drawing together a more cohesive picture of Late Palaeo-Indian and Early Archaic occupations throughout many regions of the Great Lakes.

Chronological Context: A Postscript

At present, there are only a handful of dates for Late Palaeo-Indian sites. Dates from the Cummins and Sheguiandah sites in northern Ontario span the millennium from 8,000 to 9,000 years B.P. The present volume offers new sets of dates for two regions. Radiocarbon dates of 8,000 B.P. and younger, have been obtained from two sites well north of the Great Lakes (see Hamilton, this volume; also Pilon and Dalla Bona, this volume). In addition to dating the associated occupations, they suggest Late Palaeo-Indian progenitors for the Early Archaic human occupants of these newly emergent environments. The geological origins of a second set of dates relate to the northern margins of Lake Superior and the upper peninsula of Michigan. These provide evidence showing the great potential of geological features in recently deglaciated regions for providing geochronological dating of archaeological sites (see Anderton *et al.*, this volume; also Phillips and Hill, this volume).

Although the standard usage of B.P. (years Before Present) is adopted for this volume, we refer readers to the significant paper by Stuart Fiedel (1999), for its thorough correction of the radiocarbon chronology for the Pleistocene-Holocene transitional period.

Editors' Note

The idea for an edited series of papers on the Late Palaeo-Indian period originated at the 1995 Ontario Archaeological Society symposium in Thunder Bay, Ontario with a session chaired by Lawrence Jackson and Don Simons. All contributions to this volume are published for the first time. Spellings follow Canadian usage, i.e. Palaeo-Indian.

Acknowledgements

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Ontario Geological Events and Environmental Change in the Time of the Late Palaeo-Indian and Early Archaic Cultures (10,500 to 8,500 B.P.)

P.F. Karrow

Abstract

The geological history of the interval 10,500 to 8,500 B.P. was dominated by glaciation in northern Ontario. Overall ice retreat was interrupted at 10,000 B.P. by the Marquette Advance. In contrast, southern Ontario was ice-free in this interval, but indirect effects of glaciation (isostatic uplift and major drainage changes) strongly affected the paleogeography. Ice, large glacial lakes, and the Champlain Sea were major barriers to northward human migration. Studies of fossil plants, insects, molluscs, vertebrates, and related changes in stable isotopes in sediments, carbonate shells, and plant cellulose, enhance knowledge of environmental change during this time. Two examples of glacial Lake Algonquin embayments along the eastern Huron shore show important but unexplained differences; the Ausable Valley has a Palaeo-Indian association (Parkhill site), but the Saugeen Valley does not. Contrasting exposure to storm waves, climate, and the effects of uplift on drainage may have been factors in this difference, or a lack of systematic search may be important.

Résumé

La glaciation a dominé l'histoire géologique des années comprises dans l'intervalle de 10 500 à 8 500 A.A. dans le nord de l'Ontario. Le retrait généralisé des glaciers a été interrompu à 10 000 A.A. par l'avance Marquette. Au contraire, le sud de l'Ontario était libre des glaces durant cet intervalle, mais les effets indirects de la glaciation (relèvement isostatique et les changements majeurs découlant des drainages) ont fortement affecté la paléogéographie. La glace, les grands lacs glaciaires et la mer Champlain ont constitué des obstacles importants à la migration humaine vers le nord. Les études des plantes fossils, des insectes, des mollusques,

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des vertébrés et des changements reliés aux isotopes stables dans les sédiments, les carbonates des coquillages, la cellulose des plantes rehaussent nos connaissances pertinentes à la compréhension des changements environnementaux qui ont eu lieu au cours de cette période de temps. Deux exemples de grands baies produites par le lac glaciaire Algonquin le long de la rive orientale du lac Huron revêtent des différences importantes mais inexpliquées; la vallée Ausable manifeste une association paléoindienne (le site Parkhill), mais non la vallée Saugeen. L'exposition différente aux fortes vagues, le climat et les effets du relèvement eu égard au drainage ont pu constituer des facteurs susceptibles d'expliquer cette différence, à moins que ce ne soit un manque important de recherche systématique.

Introduction

The period from 10,500 to 8,500 B.P. embraces most of the last part of the glaciation of Ontario. At its beginning, the ice front extended from west to east through the southern Lake Superior basin, across Ontario north of Lake Huron to Algonquin Park and into Quebec. Two ice retreats and an intervening ice readvance later extended across northern Ontario, fronting on huge glacial Lake Barlow-Ojibway (source of the northern Ontario clay belt). The last substantial ice readvance, the multiple Cochrane about 8,000 B.P., was followed by rapid destruction of the central Laurentian ice sheet and entry of the Tyrrell Sea into the Hudson and James Bay lowlands. During this time, areas near the glacier continued to experience major drainage changes, while areas farther south had already become post-glacial and change was occurring at a more leisurely pace, affected mainly by the slower processes of isostatic rebound and downcutting of streams.

Data Sources

The Quaternary geology of most of southern Ontario has been mapped at a scale of 1:50,000 by provincial and federal surveys (index map in Karrow and Warner 1990), and for most of the area covered there is considerable information available on the history and patterns of ice retreat, and the associated meltwater flow paths and glacial lakes. In southern Ontario, this history spans approximately from 15,000 to 10,000 B.P. However, for northern Ontario (north of a line through Sault Ste. Marie and North Bay) mapping has been sporadic, with patches of work in the few urban areas and in belts of Precambrian volcanic and sedimentary rocks with relatively high potential for metallic mineral deposits or, most recently, diamonds (drift prospecting focus). This is the area where glaciation continued to be dominant in the period from 10,500 to 8,500 B.P. This is also an area of more limited present-day access, and with a generally discontinuous cover of Quaternary sediments, mainly in the low areas between bald hills of Precambrian outcrop, although there are important exceptions. These exceptions are the north Huron coastal plain a few kilometres wide stretching from Sault Ste. Marie through North Bay to the Ottawa Valley, with deep Lake Algonquin clay deposits; a tract of Lake Agassiz clay plain in northwestern Ontario; a coastal fringe of glacial lake deposits along the north side of Lake Superior; the northern clay belt from Lake Nipigon to Lake Abitibi, where deep varved clays of glacial Lake Barlow-Ojibway are widespread, including a southeastward extension along the Timiskaming trough; and the James and Hudson Bay lowlands, where a deep mantle of glacial deposits with multiple tills and interglacial deposits is covered by young marine deposits of the Tyrrell Sea.

Aside from the local reports of generally mapped southern Ontario and sporadically mapped northern Ontario, comprehensive summaries by Karrow (1984), Karrow and Occhietti (1989), Dredge and Cowan (1989) and Barnett (1992), provide background and extensive reference lists. Fullerton (1980) reviewed dating control on Great Lakes history, and a review of Great Lakes history was presented by Karrow and Calkin (1985). There are also numerous theses on local projects and specific themes, although these are commonly more difficult to find. In the south, the classic regional description of physiography by Chapman and Putnam (1984) remains a standard reference. In the north, several regional studies by Zoltai (1961, 1963, 1965) and Boissoneau (1966, 1968) and a reconnaissance compilation map by Sado and Carswell (1987) help fill gaps between areas of more detailed mapping. Because of the interdisciplinary nature of Quaternary studies, numerous papers in journals, some of which are referred to below, are widely scattered through general disciplinary and ever more specialized publication outlets.

Geological History
10,500 to 8,500 B.P.

The Northern Glacial Record

Probably the principle reason for considering geological history in an archaeological context is to learn what is known of the paleogeography. Specifically, where and when were lands available for human migration and settlement, and what areas were excluded by the presence of glaciers? It is fair to say that glaciers and glacial lakes generally excluded Palaeo-Indians from much of Northern Ontario, an area northwest of Lake Superior being a notable exception. Small-scale paleogeographic maps are standard fare in reviews (see above); so they are not repeated here. In further elaboration, what was the nature of the land areas?

The position of the ice front at 10,500 B.P. can only be broadly estimated. Only a few widely scattered sites have relevant organic material for dating and there is much inference and interpolation involved in drawing ice margin positions. Many of the numerous glacial lakes are still undated, with inferred ages interpolated from the few dated sites.

The next older (pre-10,500 B.P.) well- dated site is the Two Creeks sub-till buried forest site in eastern Wisconsin (Figure 1.1:TC), with an average age of 11,890 B.P. (Kaiser 1994). This site has been the source of calibration samples for radiocarbon laboratories around the world, and numerous wood samples from there have been dated. Redating of the Cheboygan site (Figure 1.1:CB) in northern lower Michigan (Larson *et al.* 1994) indicated a similar age to that of the Two Creeks site. These sites were overrun by the subsequent Two Rivers (former Valders or Valderan) advance in Wisconsin and the Onaway advance of northern lower Michigan, but the margin of the advance (Figure 1.1:A-A') trends offshore under Lake Huron and has not been identified eastward. This margin, with an approximate age of 11,500 B.P., could reasonably be supposed to trend across the Bruce Peninsula and onto the southern Precambrian Shield east of Georgian Bay, both areas of thin drift on bedrock.

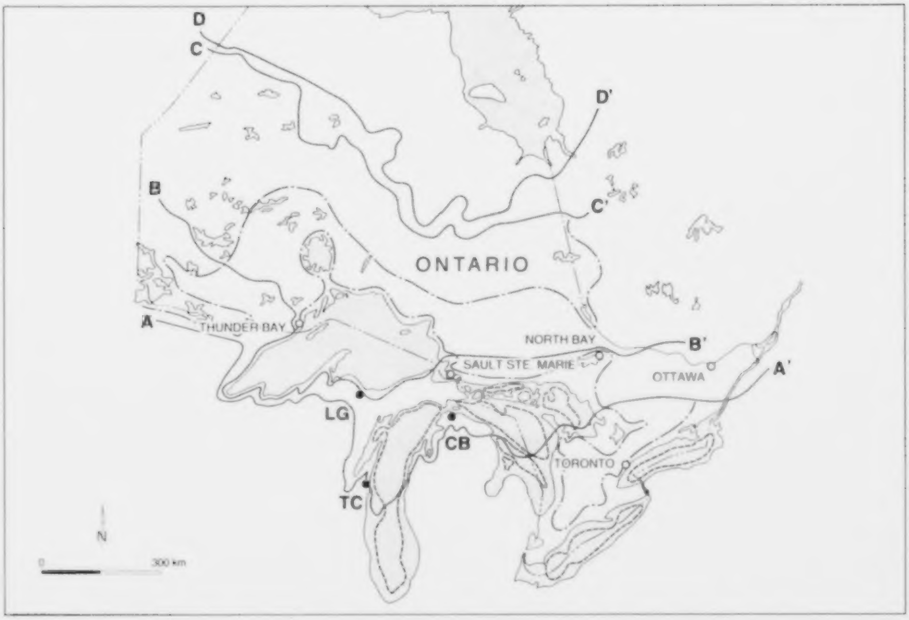

Figure 1.1 Great Lakes region and Ontario showing ice front positions at 11,500 (Two Rivers-Onaway advance: A-A'), 10,000 (Marquette advance: B-B'), and 8,000 B.P. (Cochrane advance: C-C') and dated sites at Two Creeks WI (TC), Cheboygan MI (CB), and Lake Gribben, MN (LG). The extent of large glacial lakes (dot-dash lines) and low-water residual lakes (dashed lines) are also shown. D-D' area covered by Tyrrell Sea.

The next younger (post-10,500 B.P.) well-dated ice margin position is at the Grand Marais moraine, near Marquette, northern Michigan (Figure 1.1:B-B'), where the margin of the Marquette advance flooded a forest dated 10,000 B.P. (Lowell *et al.* 1999). No other dated material defines this ice margin to the east and only a few dates are known farther west south of Lake Superior, although Saarnisto (1974) and Lowell *et al.* (1999) suggested a correlation with the Ontario Cartier moraines, and the latter identified it as the Younger Dryas ice margin in Ontario. These moraines trend eastward north of Sault Ste. Marie, Sudbury, and North Bay. Westward, the Marquette margin follows around the Lake Superior lobe to Thunder Bay, where the Marks moraine is believed to be equivalent. Opinions vary on moraine correlations farther northwestward, but Minning *et al.* (1994) suggest the Lac Seul moraine is equivalent. The southwestern Superior basin experienced a succession of glacial lakes from Lake Duluth down to Beaver Bay and Minong, the latter associated with Palaeo-Indian sites (Phillips 1988; Julig 1994; Stuart 1999).

To the north, the timing of ice retreat and glacial Lake Barlow-Ojibway is only constrained by basal bog and lake organic sediment dates, which suggest minimum ages for deglaciation, (Veillette 1994), and dates on Tyrrell Sea marine shells, which also provide minimum ages for the ice disappearance that allowed entry of marine waters from the north. These sites suggest an age of about 8,000 B.P. for the last (Cochrane) ice advance (Figure 1.1:C-C'), and shortly thereafter the arrival of the Tyrrell Sea (Figure 1.1:D-D'). Unfortunately both basal organic dates and marine shell dates are subject to errors of unknown magnitude, introducing uncertainty into this chronology (e.g. Karrow 1992).

This is the spartan chronological record of deglaciation in the northern Great Lakes and northern Ontario. However, through relationships between glacial history and related glacial and postglacial lake history we have additional information.

Lake Algonquin still existed at 10,500 B.P. and in southern Ontario its sediments have provided several wood and peat dates ranging from 11,300 to 10,500 B.P. (Karrow *et al.* 1975, 1994). Transgressive (rising) water levels of Lake Algonquin were effective in backflooding lower entering stream courses and causing baymouth bars along the shore to build upward and landward to bury lagoonal sediments. These estuarine and lagoonal sediments contain datable organic matter (Karrow *et al.* 1975, 1994; Karrow 1986b). As Lake Algonquin ended just after, we can locate the ice margin near North Bay, because its retreat opened the outlet eastward at North Bay shortly before 10,000 B.P.

After the 1950's to 1960's (Elson 1983), when multiple outlets were discovered in the Lake Nipigon district, it was generally thought that ice retreat in the Superior basin allowed eastward drainage of glacial Lake Agassiz from Manitoba between 10,000 and 11,000 B.P. The resulting multiple floods were thought to have poured through the Superior basin into main Lake Algonquin. The extent of an ice retreat is commonly obscure because the related deposits tend to be destroyed or concealed by the deposits of a subsequent ice readvance. Thus we are unsure of the position of the Superior basin ice margin at 10,500 B.P., at which time it is thought that the ice was in recession. More uncertainty was added by Minning *et al.* (1994:60), who concluded from several earlier studies and their own evidence in northwestern Ontario, that Agassiz drained eastward only once – at 9,500 B.P. Smith and Fisher (1993) and Fisher and Smith (1994) who presented evidence of northwestward Agassiz drainage across the prairies to the Arctic Ocean further weakened the former interpretation of Agassiz drainage. In any case, the ice readvance from an uncertain position in the Superior basin blocked drainage in northern Michigan to drown a forest at Lake Gribben 10,000 years ago (Figure 1.1:LG), then resumed its retreat. This was close in time to the time when the ice front was near North Bay.

Following the opening of the North Bay outlet (Figure 1.1), which took place as a series of steps related to multiple outlet channels south of North Bay (Harrison 1972), water levels in the Michigan, Huron, southeastern Superior, and Georgian Bay basins dropped from their high levels to far below present lake levels, a total drop of about 150 metres (except for Superior, which was held up by bedrock and glacial drift sills near Sault Ste. Marie). This major drop in lake levels exposed the large areas of former lake bottom we know, above present lake levels in Bruce, Grey, and Simcoe counties, large areas on the Shield in the Parry Sound area, and large areas now submerged under present lake levels in Georgian Bay, Lake Huron, and Lake Michigan. Descent to these lower levels is dated by a lower stream terrace date near Kincardine at about 10,000 B.P. (Karrow 1986) and an increasing number of dates on submerged stumps from various depths in the Michigan, Huron, and Georgian Bay basins (see Janusas *et al.* this volume).

Also close in time is the record of Lake Agassiz changes in level from near Fort Frances, northwestern Ontario. Lake Agassiz water levels declined over time as a result of the interaction of isostatic basin tilting, outlet erosion, and the opening of lower outlets as the glacier retreated (Teller and Clayton 1983). There was a notable temporary reversal when drainage (southeast or northwest?) was blocked by ice readvance and stream and bog deposits that had formed on the exposed Agassiz lake floor in the Moorhead low water phase were submerged by rising waters of the Emerson phase. The blockage was traditionally correlated with the Superior basin Marquette advance blocking eastward outlets. Bajc *et al.* (2000) found much new evidence of the Moorhead low phase near Fort Frances, with radiocarbon dates at several sites of 10,800 to 9,920 B.P. The temporary rise in the Emerson phase was then followed by resumed decline of levels as eastward outlets at Lake Nipigon allowed floods into the Superior basin about 9,500 B.P. Later, Agassiz drained eastward into Barlow-Ojibway, whose waters drained southward into the Ottawa Valley (Veillette 1994) causing complex backflooding into the Huron basin (Lewis *et al.* 1994).

Events in the South

Before carrying Agassiz meltwater eastward to join Algonquin water bound eastward, we should pause to summarize the state of affairs in the lower Great Lakes basins and the Ottawa and upper St. Lawrence valleys. These areas had been deglaciated for hundreds to thousands of years.

The Erie basin, being the southernmost, was first to be deglaciated after about 15,000 B.P., and a declining succession of glacial lakes, which had submerged the land far inland from the present shore, followed the retreating ice and provided a broad water barrier to the arrival of plants and animals into southwestern Ontario. Ice retreat was great enough to allow temporary eastward drainage and lower water level below the present in the Erie basin. There was a reversal of this trend at 13,000 B.P. at the time of the Port Huron advance when ice re-entered the eastern Erie basin and dammed glacial meltwater to the Whittlesey level (Barnett 1979). By this time, Ontario Island had come into existence in the high ground of southwestern Ontario. The name derives from the presence of the shrinking Huron, Georgian Bay, Simcoe, and Ontario lobes on three sides and glacial lakes on the fourth – undoubtedly a hostile environment for life, which experienced permafrost (Morgan 1982) and tundra conditions. A forest-tundra plant assemblage had managed to secure a foothold, however, by 13,300 B.P. (Warner and Barnett 1986; Morris *et al.* 1993), perhaps aided by the lowered lake levels and eastward drainage in the Mackinaw Interstade.

After the Port Huron advance, Erie lobe ice subsequently retreated to become the Ontario lobe, the Erie basin drained to below the present lake level (Figure 1.1), and glacial Lake Iroquois formed in the Ontario basin well before 12,000 B.P. The Huron lobe came to act in concert with the Ontario lobe as both retreated from their Port Huron marginal equivalents and proglacial meltwaters in the Huron and Georgian Bay basins became Lake Algonquin. The deglaciated and dewatered Ontario Island, with its level Stratford and Dundalk till plains and lake plains to the south, probably was poorly-drained land which dried out only gradually and partly as stream valleys deepened and water tables dropped. Such remnants as Ellice Marsh north of Stratford, Luther Marsh near Orangeville, and Greenoch Swamp near Walkerton probably indicate the former presence of much larger tracts of shallow lakes, marshes, and swamps, uninviting to many forms of life.

Retreat of the Huron, Georgian Bay, and Simcoe lobes allowed an outflow flood through the Fenelon Falls outlet (Finamore 1985) down the Trent Valley (Figure 1.1) to Lake Iroquois in the Ontario basin. With its outflow at Rome, New York, Lake Iroquois was contained by the retreating Ontario lobe until outflow became possible in the northern Adirondack Mountains at Covey Hill, south of Montreal. Algonquin outflow continued down the Trent Valley into declining levels in the Ontario basin, while uplift of the Fenelon Falls outlet caused Algonquin waters to transgress southward toward the Port Huron outlet between 11,300 (and probably earlier) and 10,500 B.P. (Karrow *et al.* 1975, 1994; Karrow 1986b). Some (e.g. Kaszycki 1985; Larsen 1987; Clark *et al.* 1994) believe that transgression never reached the Port Huron level to drain south into the Erie and Ontario basins, but the traditional view is that it did. Pengelly *et al.* (1996) describe evidence from the Niagara area supporting drainage through the Erie basin at this time. This controversy and its relationship to Palaeo-Indian history has recently been discussed by Jackson *et al.* (2000). If there was an eastern Agassiz outflow at 10,500 B.P., it would have been sufficient to guarantee Port Huron outflow in any case. This flooding would have carried through the Erie basin into the Ontario basin when lake levels were still below present, as the subsequent uplift of the outlet at Niagara raised the Erie basin to the present, and residual bodies of water in the Erie basin swelled to submerge large areas of land. Submerged forests in the western Erie basin have been dated 12,000 to 10,000 B.P. (Coakley and Lewis 1985). The comparable Ontario basin outlet rise (Kingston) and transgression following Iroquois drainage has been described by Coakley and Karrow (1993).

Iroquois drainage at Covey Hill lowered Ontario basin water levels some 130 m to that of the early Champlain Sea, which existed about 12,000 to 10,000 B.P. (Gadd 1988). This marine water body submerged land in the St. Lawrence and Ottawa valleys still isostatically downwarped, and like glacial lakes to the west, was a major barrier to northward plant and animal migration. Even though the sea level was rising as ice sheets melted, isostatic land uplift was more rapid, and over about 2000 years the sea shrank down to near its present extent in the St. Lawrence estuary. At its maximum, however, a portion of present-day eastern Ontario was covered, and there were projections up the St. Lawrence Valley into the Ontario basin (kept fresh by rivers) and the Ottawa Valley to Pembroke. It was into the late and lowered marine water of the Champlain Sea that Algonquin water, perhaps augmented about then by Agassiz water, escaped at North Bay just before 10,000 B.P. Critical chronological relationships around then become lost in two radiocarbon dating plateaux (whereby ages over a span of several centuries yield the same radiocarbon date: Becker *et al* . 1991; Wohlfarth 1996) and laboratory analytical error ranges. If Agassiz outflow was eastward only at 9,500 B.P., it would have been into still elevated levels in the Superior basin as Marquette ice retreated, then into low Stanley and Hough levels of the Huron and Georgian Bay basins, then through North Bay and down the Ottawa and St. Lawrence valleys. By then there was no longer a Champlain Sea.

So, what was the picture in the south in the first quarter of the 10,500 – to 8,500 – year interval under consideration? Waters in the Erie and Ontario basins were still much below present (Figure 1.1) but rising, as their Niagara and Kingston sills were raised isostatically. The rate of isostatic rise at that time was much more rapid than now and there are indications earthquakes were more frequent. Early Lake Erie and early Lake Ontario were substantially less extensive than the present lakes and there were flat areas of former lake bottom being dissected by extended stream valleys around the margins of these smaller "Great Lakes."

During this same interval, Lake Algonquin was lowering as the retreating ice uncovered the succession of lower outlets south of North Bay. The large step-wise outflows lowered levels through the several post-Algonquin lakes (Harrison 1972), exposing more and more former lake bottom (Figure 1.1) and extending inflowing streams across the flats. By about 10,000 B.P., the lowest levels of Lake Hough (Georgian Bay), Lake Stanley (Huron), and Lake Chippewa (Michigan) had been reached, all at progressively higher levels westward with eastward-flowing stream links between them. Concurrently, in the Ottawa Valley, the shrinking Champlain Sea exposed a flat sea floor, also attacked by lengthening streams, which easily cut into the soft sediments. Effects of Huron basin backflooding events on lake history in the eastern Niagara Peninsula are discussed by Pengelly *et al.* (1997).

There have been few studies of the development of stream valleys in southern Ontario. Present impressions are that valleys were cut down rapidly, generally keeping pace with lowering lake levels during ice retreat. The earliest valley cutting took place while glacial meltwaters still prevailed and the present form of the topography probably was largely established in late-glacial times. Landscapes subsequently changed little as swamps and lakes gradually infilled with organic sediments, and slopewash developed small alluvial fans at the bases of steeper slopes. The dominant processes were those of weathering and gradual removal of material by erosion to be deposited in the expanding Great Lakes. There is only a very limited accessible sediment record covering this postglacial time. Lakes and bogs, which provide a dominantly organic record, have been most studied for their record of vegetation changes. Of limited extent and volume, colluvial and alluvial sediments remain almost completely unstudied in Ontario.

What do we know of the interval from 10,000 to 8,500 B.P.? We know very little of the geological record in the south. Lake levels were rising absolutely, in the Huron, Erie, and Ontario basins, with their outlets uplifted faster than their more southerly basins, but relatively falling along the northeast Superior shore which experienced retreating waters as the land rose faster isostatically than the outlet at Sault Ste. Marie. Rising Great Lakes levels encroached on the expanded land areas, but Huron, Erie and Ontario coasts and stream mouths were located well offshore from the present shorelines and they are now submerged below present lake levels. Also, along most southern Great Lakes coasts, rising waters have advanced through erosion of shorecliffs. In the Huron basin, coastal erosion has aggressively devoured land and removed the raised shoreline of glacial Lake Algonquin (Karrow 1986a). Cliff retreat around the Great Lakes has likely removed a great deal of evidence of the record of human coastal habitation. Evidence of this is particularly striking where stream terraces are left hanging (Karrow 1986b; Barnett 1998).

The Fossil Record

The remains of animals and plants are often found in Quaternary sediments. Because most species found are still extant, the usual assumption, supported by the nature of fossil assemblages, is that their environmental affiliations were the same in the past as they are today. This is the basis of paleoecological interpretation, which allows reconstruction of past environments, including climate, currents and depths of water, water chemistry, drainage changes, etc. Since fossil assemblages change in stratigraphic sequences and these can be dated (principally by radiocarbon), it is possible to construct a history of environmental change.

While the record of paleoenvironmental change is based on the sedimentary sequence, as explained above, that record for 10,500 to 8,500 B.P. is dominated in volume by glacial and glacial lake sedimentation, with a strong northern skew. The fossil record is a non-glacial record, derived from mainly lacustrine and paludal sediments, with very little attention having been given to sediments of fluvial, colluvial, and eolian origin. Of the many types of fossils available for study, most have been given only limited attention. Four of the groups, which have attracted more study, are summarized here, followed by brief comments on isotopic geochemistry, which is closely linked to the study of fossils.

Plants

Paleoenvironmental research has been, and continues to be, dominated by palynology. MacDonald (1990) has reviewed the methods and applications of palynology. The pollen record has been given most attention for several reasons: viz plant assemblages show a good general correlation with climate and are well represented by pollen, pollen grains are widely dispersed by wind and are incorporated into most aquatic sediments, pollen grains are relatively durable and commonly preserved, and since pollen grains are very small, only small samples are needed for statistically valid analysis. Among the disadvantages are the ready destruction of pollen by oxidation so sediments above the water table lose their pollen to weathering, the usual limit to identification beyond genus, and the wide dispersal by wind yields generalized, more broadly regional records. In any case, there are more pollen studies than any other type of fossil study. Some pollen work is accompanied by study of plant macrofossils (seeds, leaves, needles, and wood), that require larger samples but provide good evidence of the local presence of plant species (Warner 1990).

Compilation of pollen work in Ontario was carried out by Holloway and Bryant (1985) and, for southern Ontario by Karrow and Warner (1990), and McAndrews (1994). Many sites have been studied in southern Ontario, published in journal papers, monographs, and theses; some are unpublished in private files. In the north, studies are far fewer because of poor access and a more generalized modern boreal vegetation. Series of northern sites have been reported by Terasmae (1967); Saarnisto (1974); McAndrews (1981); and Bjorck (1985).

Pollen studies have given us a good general picture of the changes with time of the vegetation. Karrow and Warner (1990) presented a general or average pollen diagram for southern Ontario representing postglacial time (Figure 1.2). Bernabo and Webb (1977) documented the general time-transgressive migration of vegetation zones (pollen assemblages) through the Great Lakes area and Muller (1999) refined it based on the movement of individual species. The availability of such data makes it possible to use pollen analysis to estimate the age of pollen-bearing sediments. Karrow *et al.* (1975) averaged the records from several sites and concluded that the spruce-pine transition had an age of about 10,600 B.P. in the southern Great Lakes area. Bernabo and Webb (1977) documented the migration of that transition through the same area at a slightly younger age; and, more recently, Muller (1999) suggested an age of between 10,500 and 10,000 B.P. in southern Ontario. The time span on which this review is focused corresponds rather well in southern Ontario with the pine pollen assemblage zone. It is thought that the climate then, was warmer (the early part of the "Climatic Optimum") and drier than the present (Karrow and Warner 1990). Drier conditions were favoured too by the greatly reduced extent of lakes in the Huron-Georgian Bay, Erie, and Ontario basins (Figure 1.1).

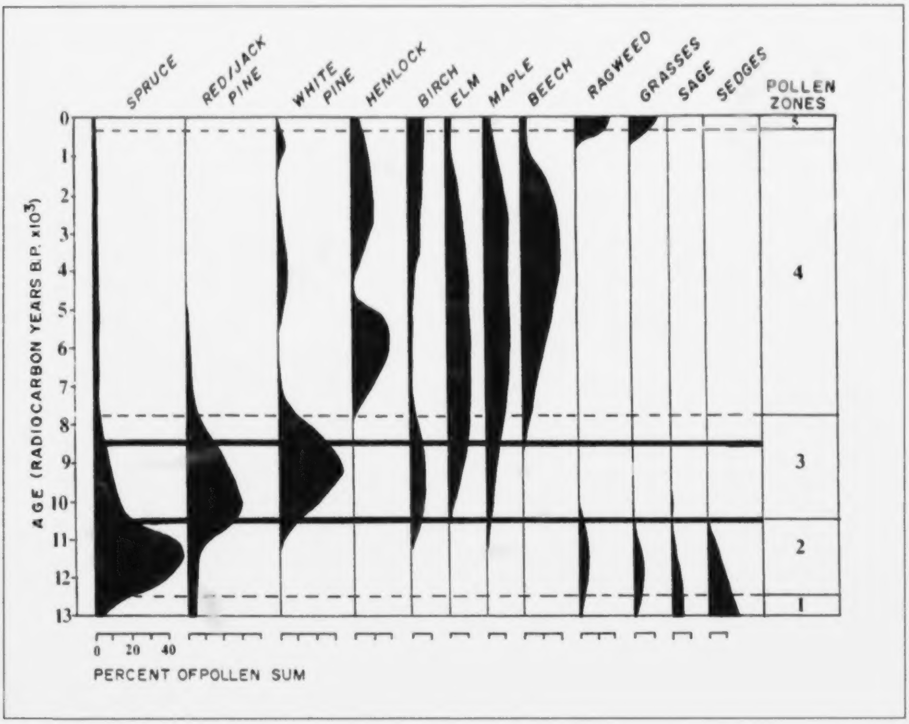

Figure 1.2 Generalized Pollen Diagram for Southern Ontario (after Karrow and Warner, 1990). The interval 10,500 to 8,500 is highlighted by heavy horizontal lines.

Most paleoecological work yields limited data directly related to human use of plants as food. There could be more integration of archaeological data on plant food remains into the fabric of paleoecology.

Insects

Next after plants, the insect record has also been extensively studied in the Great Lakes area. Morgan (1987) and Morgan and Morgan (1990) have reviewed the methods and philosophies of insect studies.

Insect remains are widely distributed in fine-grained aquatic and organic sediments, and insects are thought to respond more quickly than plants, because of their mobility, to climatic change. A disadvantage is that for significant faunal representation, much larger samples are required for analysis. With the potential for large and diverse faunas, commonly poorly represented in fossil assemblages, it is not usual to present insect data in diagrams as is done for pollen, but rather to compare the general character and affinity of assemblages. Interpretations of local environments and climate result.

The first study of late-glacial insect assemblages in Ontario was on Lake Algonquin transgression deposits in the estuary of Eighteen Mile River, south of Kincardine (Ashworth 1977). These deposits, with a spruce wood date of 10,600 ± 160 (GSC-1127), were formed at the beginning of the time span under consideration, and late in the history of Lake Algonquin, when the ice margin had retreated to northeastern Georgian Bay. The assemblage included over 80 species compatible with the plant assemblages indicating cooler conditions than the present. Morgan *et al.* (1982) summarized knowledge of insect assemblages from the 11,000 to 10,000 B.P. period. At the Rostock mammoth site near Stratford (Pilny *et al.* 1987), insect assemblages spanning from about 13,000 B.P. up to the mammoth bone horizon with an age close to that of the Eighteen Mile River site, recorded change from northern boreal to southern boreal vegetation. A greater time range (13,000 to 7,000 B.P.) was represented at the Gage site in Kitchener (Schwert *et al.* 1985), where insects also record the warming climate during the spruce, pine, and early hardwood forest zones. Morgan (1988) concluded that by 10,000 B.P. July mean temperatures at southern Ontario inland sites were probably similar to those of today.

Molluscs

Mollusc shells, typically white compared to brown enclosing sediments, are the most obvious animal fossils found in Quaternary sediments. Their use in paleoecology and the associated assumptions and variables has been reviewed by Miller (1978) and Miller and Bajc (1990).

Molluscs have broader environmental tolerances than plants and insects. Aquatic forms are less sensitive to climatic variables than are terrestrial species, but aquatic taxa are more readily preserved and much more commonly found than terrestrial. Molluscs have been studied from glacial lake lagoonal and estuarine sediments, with most attention given to the deposits of Lake Algonquin and successor alluvial terrace and Nipissing sediments, providing a means of distinguishing the ages of the deposits (Miller *et al.* 1985). These yield a discontinuous record from 11,000 to 4,000 B.P. Bajc (1986) described the succession of glacial and post-glacial lacustrine molluscan assemblages in northeastern Lake Superior spanning the last 9,500 years. These studies have provided a basis for inferring a chronology of drainage changes and molluscan migration routes.

Continuous postglacial sequences have as yet been given little study. Marl deposits, rich in molluscan shells, remain a potentially large resource for study of environmental change and documentation of paleobiogeography. Yang *et al.* (2001) have documented changes in two marls near Waterloo, Ontario. When alluvial and colluvial sediments get more attention, molluscs will figure prominently in their biotic record and such sediments have greater potential for involvement in the archaeological record than do those of glacial lakes. Thus far, there seems to be little record of molluscs as a human food source in the region, unlike marine coastal settings where shell middens are prominent features of the archeological record.

The Champlain and Tyrrell seas extended into eastern and northern Ontario, respectively, and there too, molluscs are the most abundant animal fossils encountered. Wagner (1970) and Rodrigues (1988) described the faunas of the Champlain Sea and their areal and stratigraphic indications of variations in salinity and temperature. Wagner (1969) and Dyke *et al.* (1996) described Tyrrell Sea (Hudson Bay area) faunas. No shell middens have been described along the margins of these seas.

Vertebrates

Vertebrates have long attracted public interest and are the best known of all groups of Quaternary fossils. They have long established links with human history. Unlike certain favourable areas such as the Plains (e.g. Alberta, Nebraska) or Florida, where vertebrate bones may occur in large concentrations, in the Great Lakes area fossil vertebrates are usually recorded as isolated disarticulated single bones, more challenging to the taxonomist and usually precluding analysis of species assemblages. The temporal focus of this review spans the time when a large-mammal fauna (horses, elephants, camels) became extinct in North America. Some of these impressive extinct species (e.g. mammoth) are commonly used as symbols of Quaternary life. Churcher and Wilson (1990) have summarized the occurrence, study, and contributions to paleoecology of vertebrates.

Most prominent by far are the numerous occurrences of mastodon reported from a belt across the southern Great Lakes; in Ontario this belt extends along the north shore of Lake Erie, where more than 60 finds are known, primarily from wet depressions. Almost no detailed study of any of these sites has been undertaken. Dreimanis (1968) and McAndrews and Jackson (1988) have suggested warmer and drier conditions, and associated vegetation changes may have contributed to their extinction. Much rarer mammoth occurrences are more widely distributed, with several finds in the glacial Lake Iroquois beach (Karrow and Warner 1990). A mammoth from Rostock, with an age of 10,790 ± 150 (WAT-999), was given more detailed study of associated plants and insects by Pilny *et al.* (1987) and McAndrews and Jackson (1988). Unlike some other famous proboscidian sites, no human association has been documented for any of these Ontario sites. However, a focus on patterns of movement of "game" (mammals) is a standard part of the strategy in the search for early human sites, commonly related to raised lake shorelines (Phillips 1988).

Potentially much more numerous, but as yet largely unstudied, are microvertebrates (rodents, fish), generally not seen in the field but sometimes encountered incidentally to the study of more common and obvious molluscs or plants. It is likely too that when detailed excavations of large mammal sites are undertaken, small vertebrates will also be found and will enhance paleoenvironmental interpretation. A major problem in the case of terrestrial species is preservation, and poorly drained high water table sites are the most likely to preserve remains, already a known association for mastodon sites.

There is a notable vertebrate fauna from the Champlain Sea (Harington 1988). Five species of whales (mostly beluga) from 23 sites and at least four seal species from 22 sites extend through the area covered by the Sea. Dates range from 9,500 to 11,500, with most between 10,000 and 10,500 B.P. There is an unusual occurrence of mainly fish remains in carbonate concretions from near Ottawa (McAllister *et al.* 1988) with a single date of near 10,000 B.P. (Gadd 1980), suggesting presence at the end of the Champlain Sea. No human associations are known for these vertebrate faunas, which are consistent in their paleoecology with an ice-marginal sea. Dating of marine mammal bones at sites far inland as only a few centuries old has indicated a human agency in their anomalous presence (Harington 1988).

Geochemical Data

Paleoenvironmental data can also be derived from geochemical analyses of stable isotope variations (C, O, H), as contained in shell carbonate (molluscs, ostracodes), carbonate lake sediment (marl), and plant cellulose. The fact that most of these are organic media, links stable isotope geochemistry to the fossil record.

Oxygen isotope variations (^{18}o, ^{16}o) are best known as paleotemperature indicators from deep sea cores, particularly as recorded in foraminifera. Similar records are obtainable in fresh water environments, except that initial composition for a given water body does not have the relative constancy for long periods displayed by sea water, so that changes in time are more relative and less absolute. Even though the analytical data are appealingly quantitative, with analyses to several decimal places of accuracy, interpretations tend to be descriptive, with many generalizations like those associated with data from fossil assemblages.

While oxygen isotopes are best known for paleotemperature records, ^{13}C: ^{12}C and ^{2}H:^{1}H have provided data on past humidities. When all are combined, good indications of the major parameters (temperature and precipitation) of past climates are obtainable. When combined with tree ring data, there is the potential for developing annual or even sub-annual records. Thus far, such detailed records have mainly been derived for the last few centuries (Edwards and Buhay 1994). For earlier times some analyses are available for wood samples averaged over several or even tens of years. Figure 1.3 shows derived temperature and humidity records for the past 12,000 years based on wood analyses from Brampton (Edwards and Fritz 1988) and several lake marls in south central Ontario (Fritz *et al.* 1987).

Attempts to match stable isotope records from Great Lakes cores to the well-established correlations between climate, palynology, and isotopes in northwest Europe, yielded isotope records registering both hydrologic changes and temperature (Fritz *et al.* 1975). Later, isotopes were used to clarify Great Lakes history, incorporating the effects of inflows from Lake Agassiz (Lewis *et al.* 1994).

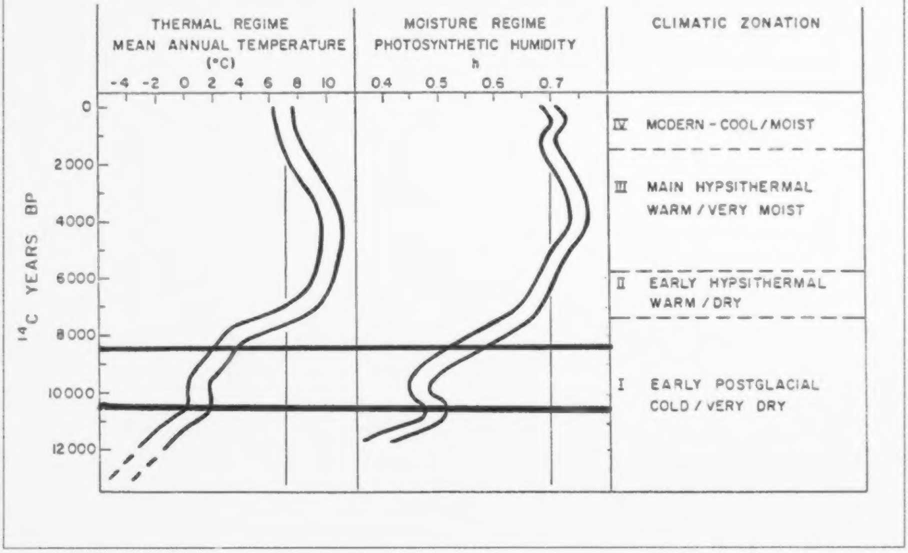

Figure 1.3 Generalized Climatic Curves from Stable Isotope Studies (after Edwards and Fritz, 1988). The interval 10,500 to 8,500 B.P. is highlighted by heavy horizontal lines.

Two Case Study Examples

Stein and Linse (1993) and Karrow (1994) commented on the difference in scale between most geological and archaeological work. Much of what has been said in this paper, like most reviews, has been small-scale generalization – looking at the big picture – whereas archaeological site investigations are at the other end of the scale, being directed towards vastly greater detail and "microstratigraphy." To help bridge the scale gap, two examples of local areas, which have relevance to archaeology, are dealt with more specifically. Both are at the mouths of river valleys that formed embayments along the Lake Huron shore of glacial Lake Algonquin. One, near the mouth of the Ausable River at Grand Bend, has a well-known association with Palaeo-Indians (Ellis and Deller 2000). The other, near the mouth of the Saugeen River at Southampton, as yet has only the potential for demonstrating such an association.

Ausable Valley

The area's Quaternary geology (Figure 1.4) is shown on a 1:50,000 scale map and is described in a report by Cooper (1979). The Algonquin shoreline has been overprinted by the Nipissing shoreline (Karrow, 1980); associated water bodies were at about the same level. The river mouth formed a lagoon bounded on the west by separate Algonquin and Nipissing baymouth bars. Crowned by large sand dunes, the Nipissing bar complex has

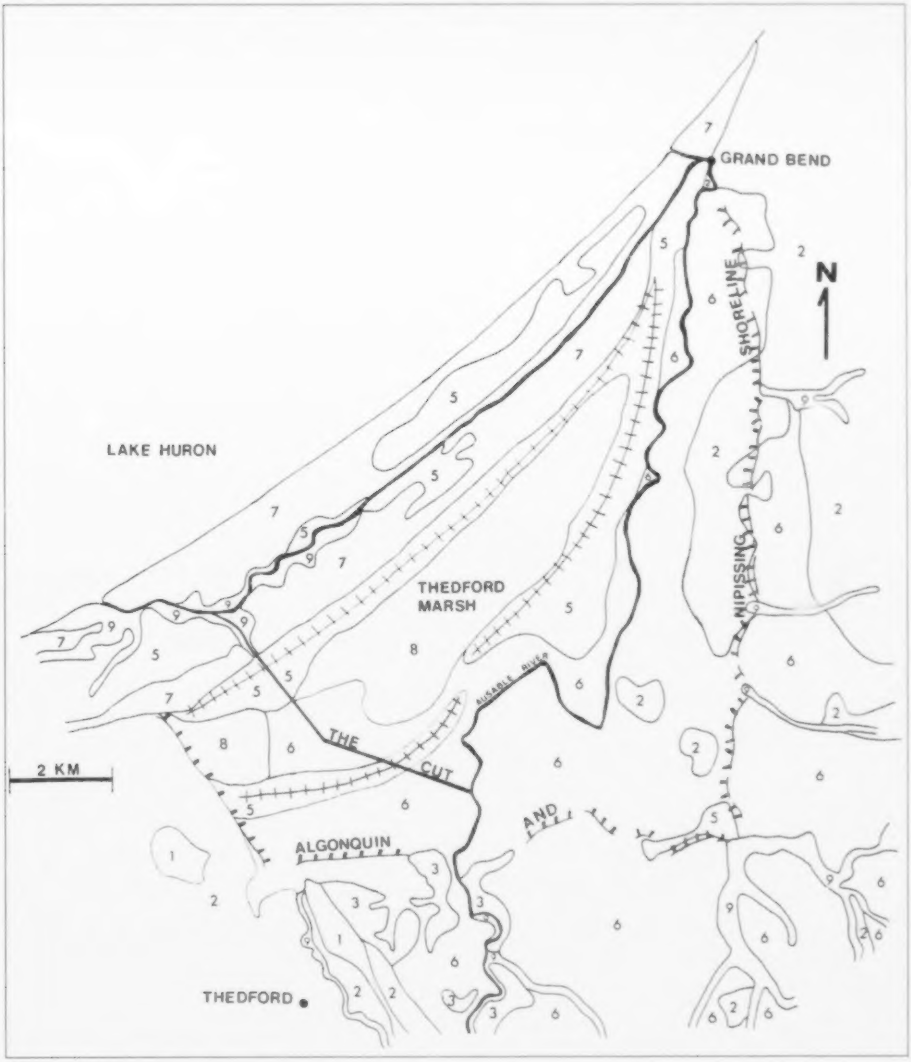
GRAND BEND
N
LAKE HURON
THEDFORD MARSH
AUSABLE RIVER
THE CUT
ALGONQUIN
AND
NIPISSING
SHORELINE
2 KM
THEDFORD

Figure 1.4 Ausable River Valley Mouth Showing Geological Features after Cooper (1979). The extent of organic soils (former swamp) is as given by Matthews *et al.* (1957). Legend: 1. bedrock – Devonian limestone and shale. 2. Till – clay-rich St. Joseph Till. 3. Glaciofluvial outwash and ice-contact sand and gravel. 4. Glaciolocustrine shallow-water sand. 5. Glaciolacustrine beach sand and gravel. 6. Glaciolacustrine deep-water clay and silt. 7. Eolian dune sand. 8. Swamp, bog, and marsh peat and muck. 9. Stream alluvium – sand, gravel, silt, peat. Single hatched line – shorebluff. Double hatched line – barrier bar.

been studied in some detail by Johnston (1999). The subdued Algonquin bar is mantled by fossiliferous Nipissing silt and trends parallel to the Nipissing barrier a few kilometres inland. Lagoon silts and clays, carried into the Algonquin and Nipissing waters as they transgressed about 10,500 and 5,500 years ago respectively, were trapped by the bounding baymouth bars. Palynological studies conducted by Fitzgerald (1976) have determined that lagoon sediments were capped by the organic sediments of Thedford Marsh.

Roosa (1977) described artifacts from the Early Palaeo-Indian (i.e. fluted point) Parkhill site, and Deller (1979) and Ellis and Deller (1986) documented Early and Late Palaeo-Indian sites both above and below the Nipissing/Algonquin level in the embayment, noting an association with quiet lagoon waters and/or, after lake drainage, with swampland. Inasmuch as drainage of the Thedford Marsh is a recent event (European agriculture), the swampland and lake environment was probably in existence for thousands of years after the Nipissing transgression and for at least several centuries at the time of the Algonquin transgression (Jackson *et al.* 2000).

Although Huron basin water levels retreated to the low Lake Stanley level in between Algonquin and Nipissing, whatever stream dissection and water table lowering occurred, accompanied by development of paleosols, was masked by the transgression of Nipissing waters again to the Algonquin level and aggradation by the Ausable River. Future investigation may discover evidence of the buried drainage system and topography related to the low Lake Stanley interval. Water level drops as the North Bay outlets opened would have been sudden, but the Nipissing transgression and rising water levels would have been gradual, as a result of slow isostatic uplift.

Saugeen Valley

About 150 km north of the Ausable Valley, the Saugeen River also enters Lake Huron (Figure 1.5) after passing through a former Lake Algonquin lagoon and barrier bar (Sharpe and Edwards 1979). Isostatic uplift affected the older Algonquin shoreline more strongly than the Nipissing, so instead of being nearly coincident as at Grand Bend, here they are separated by about 30 m in elevation. Away from the valley mouth embayment, prominent Algonquin shorebluffs are present (Karrow 1988). The low Nipissing shorebluff extends across the front of the Algonquin barrier and lagoon.

There has been greater isostatic uplift at the Saugeen Valley since Lake Algonquin time, so the Saugeen River has higher banks where it crosses its embayment than does the Ausable. The Saugeen River and its embayment tributary, Mill Creek, have cut down to reveal 10 m of fossiliferous Algonquin clay and silt (Miller *et al.* 1985; Silis 1999). In the lowest part of the valley at Southampton, fossiliferous Nipissing silts overlie a paleosol under a Nipissing terrace. Rapid uplift and stream incision are probably the reasons why no marsh or swamps developed on the open Algonquin embayment floor. Unstudied marsh and a remnant lake (Lake Arron) are located on the north flank of the embayment. Since the Nipissing transgression remained substantially lower than the Algonquin level, the base level of erosion never rose high enough to create swamp or marsh in the embayment at that time.

There is a notable lack of a Palaeo-Indian record in the Saugeen area (C. Ellis and P. Storck, personal communications, 2000) perhaps because of the limited swampland. The occur-

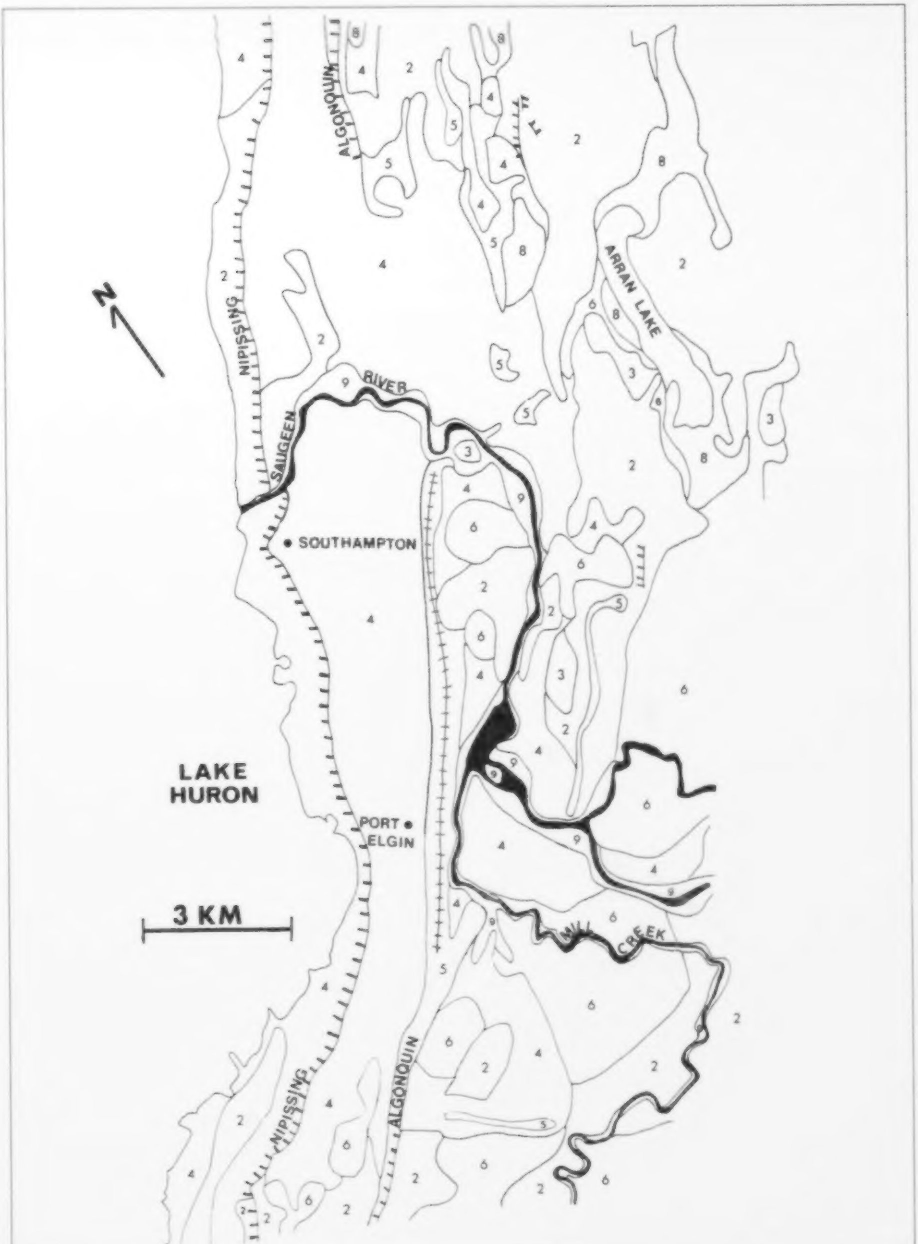
N
NIPISSING
ALGONQUIN
ARRAN LAKE
SAUGEEN
RIVER
SOUTHAMPTON
LAKE HURON
PORT ELGIN
3 KM
MILL CREEK
ALGONQUIN
NIPISSING

Figure 1.5 Saugeen River Valley Mouth Showing Geological Features (after Sharpe and Edwards (1979) and Sharpe and Jamieson (1982)). Legend as for Figure 1.4.

rence of a mammoth to the east at Tara shows the presence of some large game. Perhaps a more salubrious climate at Parkhill, or greater protection from open lake storms as at the Fisher site south of Collingwood (Storck 1997), favoured Palaeo-Indian presence, whereas the open exposure to northwest storms discouraged it at the Saugeen Valley. Perhaps only an appropriate search is needed to discover the evidence of Palaeo-Indians in the Saugeen area. Although evidence of post-4000 B.P. occupation is well established (e.g. Finlayson 1977; Rankin, 2000), earlier sites have so far eluded detection.

Acknowledgements

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2.

Changing Our Views of Late Palaeo-Indian in Southern Ontario

Lawrence J. Jackson

Abstract

Emerson Greenman's early explorations of Late Palaeo-Indian sites on isostatically raised glacial lake beaches along the north shore of Lake Huron led to definition of an Upper Great Lakes "Aqua-Plano" culture. A scarcity of similar sites in southern Ontario has long suggested a contrastingly ephemeral occupation zone. Careful examination reveals that significant sampling biases in southern Ontario have been ignored. Recent geological studies of the Great Lakes basins strongly suggest that flooding of extensive lake margin areas has made many once-occupied areas inaccessible to researchers. Survey data for southern Ontario documents seven distinct Late Palaeo-Indian point types in a broad distribution corresponding mainly to regions of high survey activity. A time series is suggested by comparison with stratigraphically sequential Plains points (Agate Basin, Hell Gap, Eden-Scottsbluff) and by similarities to both earlier and later point types (such as Crowfield fluted points of the Early Palaeo-Indian period and side-notched points of the Early Archaic). Evidence for regional trends in type distribution is discussed and an Ontario time series is suggested for the period 10,300 to 8,500 B.P.

Résumé

Les premières explorations effectuées par Emerson Greenman visant à détecter des sites paléoindiens sur des terrasses affectées par le relèvement isostatique, des lacs glaciaires situés le long de la rive nord du lac Huron ont conduit à la définition de l' « Aqua-Planoïen », culture des Grands Lacs supérieurs. Au contraire, la rareté de tels sites dans le sud de l'Ontario a depuis longtemps permis de conclure à une zone d'occupation éphémère. Un examen minutieux révèle cependant que des distorsions significatives sont dues à la nature de l'échantillonnage. Des études géologiques récentes dans le bassin des Grands Lacs suggèrent fortement que l'inondation de grandes étendues situées au bord du lac ont rendu inac-

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cessibles aux chercheurs ces régions autrefois occupées. Des reconnaissances effectuées dans le sud de l'Ontario ont décelé sept types distinctifs de pointes du Paléoindien supérieur dont la grande distribution correspond principalement aux régions qui ont fait l'objet de nombreuses reconnaissances. On suggère une série temporelle établie par la comparaison avec des pointes découvertes en couches successives dans les prairies (Agate Basin, Hell Gap, Eden-Scottsbluff) et par les similitudes qu'on remarque avec des types de pointes plus anciennes ou plus récentes (telles que les pointes cannelées de Crowfield du Paléoindien inférieur et des pointes à encoches latérales de l'Archaïque inférieur). On passe en revue les indices des tendances régionales révélées par la distribution des types et on suggère une série temporelle pour la période 10 300 à 8 500 A.A. en Ontario.

Introduction

In 1938, Emerson Greenman of the University of Michigan began investigating a series of lanceolate point sites associated with raised beaches in the Upper Great Lakes – specifically the Canadian North Shore. The George Lake complex of sites along Lake Huron's north shore became well known for its association of lanceolate points and other stone tools, some waterworn, with uplifted beaches of glacial Lake Algonquin. A terminal Pleistocene age 10,000 or more years ago was inferred (Greenman and Stanley 1943).

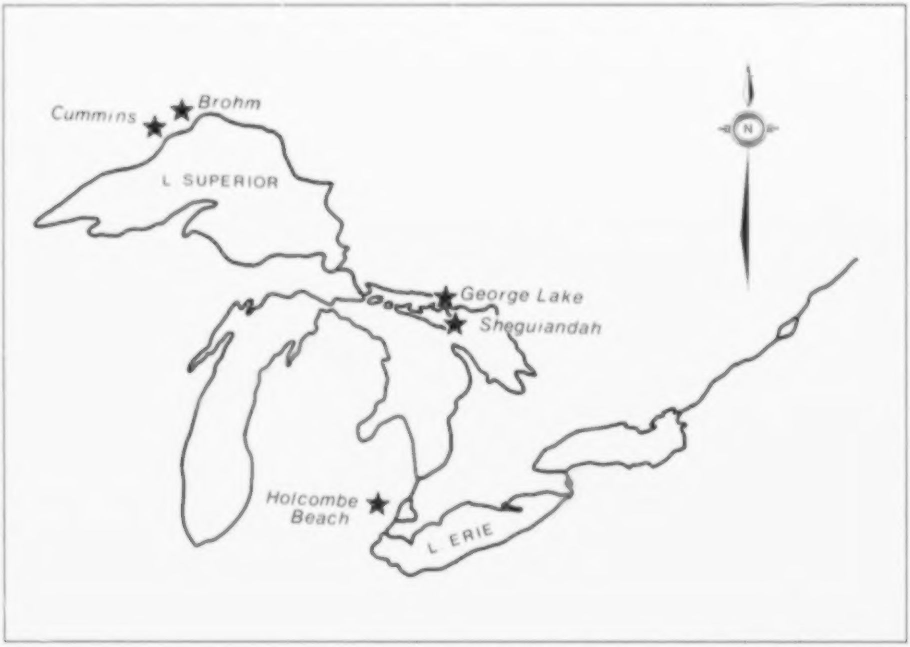


Figure 2.1 Some Major Late Palaeo-Indian Sites in the Great Lakes Region in the 1960's.

Subsequent archaeological and geological researches by a variety of researchers such as Ellis and Deller 1990; Roosa 1965; and Storck 1982), placed fluted point occupations in direct association with the glacial Lake Algonquin strandline circa 11,300 to 10,300 B.P. The uplifting of Algonquin age beaches in the northern Great Lakes area by isostatic rebound and the consequent flooding of more southerly lake margins in the same lake basins has resulted in a skewed archaeological record. While Algonquin and post-Algonquin beaches are exposed in the north, the post-Algonquin beaches are now flooded in the south – making the later age Late Palaeo-Indian strandline occupations inaccessible. More recently, Jackson *et al.* (2000) have identified the Lake Ardtrea beach (misinterpreted as Algonquin) as the primary correlate of southern Early Palaeo-Indian occupations. Algonquin and later beaches in the south were flooded by isostatic rebound/basin tilting as northern landmasses became ice-free.

Today, the Late Palaeo-Indian period remains poorly known in southern Ontario – with only a few substantial sites recorded or excavated. Our principal knowledge of this period comes from records of scattered diagnostic projectile points rather than from sites with occupational deposits or dateable hearths. Significant sites, such as Heaman in southwestern Ontario (Deller 1976) and Deavitt in south-central Ontario (Dibb 1985), have been excavated along glacial Lake Algonquin (Ardtrea) strandlines, but the greater number of finds are from isolated interior regions well away from proglacial strands. Apart from Algonquin (Ardtrea), the majority of Great Lakes strandlines dating to the Late Palaeo-Indian period, circa 10,300 to 8,500 B.P., are well submerged under rising Holocene waters.

Although early work in northern Ontario suggested a direct correlation between the age of sites and the age of associated Late Pleistocene strandlines, we now recognize that strandline ages do not correspond, generally, with the age of Late Palaeo-Indian occupations. Major northern sites, such as Brohm, Cummins, and Sheguiandah, located on or near major proglacial strand lines in northern Ontario, are assigned to the "Lakehead Complex" (Fox 1975), a loosely defined grouping of technologically similar materials. Approximate ages between 10,300 and 8,500 B.P. are assumed for such sites based on association with the glacial Lake Minong strandline and on a few radiocarbon dates for sites such as Sheguiandah and Cummins. Julig *et al.* (1986:79) radiocarbon dated bone at the Cummins site between 8,500 and 8,000 B.P.

Four radiocarbon dates from basal peat at the Sheguiandah site on Manitoulin Island in Lake Huron range between about 9,160 and 9,440 B.P., providing a base date for Late Palaeo-Indian deposits above the peat no earlier than about 9,500 B.P. (Julig *et al.* 1992). This earliest date of about 9,500 B.P. is actually 800 to 1,000 years later than the presumed earliest age of post-fluted point occupations in southern Ontario which succeed the Crowfield Phase (Ellis and Deller 1988; Jackson 1997). There is evidence to suggest that major environmental changes in southern Ontario about the time of the Pleistocene/Holocene transition (circa 10,000 B.P.) may have initiated a northward shift or penetration of earliest Holocene Late Palaeo-Indian populations. There may also have been distinct groups pushing into northwestern Ontario from the west and south in the Minnesota-Wisconsin area. In this paper, I will discuss a possible time sequence for the various post-fluted Late Palaeo-Indian point types, noting correspondences between southern and northern Ontario.

The Lakehead Complex of northern Ontario is not well defined, technologically or spatially, and has dates that seem to span more than 1,000 years. However, the term does appear to identify a distinct set of strandline-based early Holocene archaeological sites that share a number of similarities (see Hinshelwood, this volume). Earliest dates for the Lakehead Complex are later than the presumed age of earliest Late Palaeo-Indian occupations in the lower Great Lakes area beginning about 10,300 B.P.

Late Palaeo-Indian Point Types In Southern Ontario

Ellis and Deller (1990) first provided a comprehensive summary of Late Palaeo-Indian projectile points in southern Ontario recognizing two basic forms and five distinct types. Table 2.1 in this paper provides an updated inventory of Late Palaeo-Indian points in southern Ontario keyed to Figures 2.2 through 2.4. Two basic forms and seven distinct types are recognized. Unfluted leaf-shaped points specific to the Great Lakes area include the *Holcombe* and *Hi-Lo* types – first identified in Michigan at the two type sites of the same name. A third unfluted, leaf-shaped type, known as *Plainville*, was first identified in south-central Ontario in the late 1990s (see Jackson 1998). Contracting stemmed and unstemmed lanceolate points, all with strong Plains connections, include *Agate Basin*, *Hell-Gap*, and *Eden-Scottsbluff*. A fourth lanceolate type, *Madina*, was first recognized in south-central Ontario in the late 1980s (Dibb and Ellis 1988).

Table 2.1 New Records Of Late Palaeo-Indian Points In Southern Ontario (after Ellis and Deller 1990: Table 3)

Site #	Site Name	Borden No.	Researcher	Drainage	Reference
HOLCOMBE AND PLAINVILLE (HOLCOMBE-LIKE) *(Locations Keyed to Figure 2.2)*					
1.	Cherry Ridge	AgGu-45	R. Griffin-Short	L. Ontario	pers.comm.*
2.	Sturgeon Pond	AaHp-53	P. Lennox	L. Erie	pers.comm.*
3.	Buttar	BaGn-72	L. Jackson	Rice Lake	this paper +
4.	Blezard 2	BaGn-71	L. Jackson	Rice Lake	this paper +
5.	Inner City Angels	BaGn-76	L. Jackson	Rice Lake	this paper *
6.	Linton	BaGn-80	L. Jackson	Rice Lake	this paper *
7.	Flesherton	none	P. Storck	L. Huron	Storck 1972 *
8.	Saeger	AhHa-10	S. Leslie	L. Ontario	pers.comm.
9.	Fowler	BcGw-64	P. Woodley	L. Simcoe	this volume

* classed as Plainville type.

+ Buttar and Blezard 2 points, cited by Ellis and Deller (1990:Table 3) classed as Holcombe type.

HI-LO *(Locations Keyed to Figure 2.3)*					
1.	Witz	AhHa-80	P. Woodley	L. Ontario	pers.comm.
2.	Meadowbrook 1	AhHa-22	L. Jackson	L. Ontario	this paper
3.	Meadowbrook 3	AhHa-22	L. Jackson	L. Ontario	this paper
4.	Biterman	AlGt-105	D. Poulton	L. Ontario	pers.comm.
5.	Runymede	AlGs-121	G. Dibb	L. Ontario	pers.comm.
6.	Hunter's Farm	AlGr-106	D. Morrison	L. Ontario	pers.comm.
7.	Seagrave	BbGr-22	G. Dibb	L. Scugog	pers.comm.

continues...

Site #	Site Name	Borden No.	Researcher	Drainage	Reference
8.	Bebee	BaGn-68	L. Jackson	Rice Lake	this paper
9.	Blezard 1	BaGn-70	L. Jackson	Rice Lake	this paper
10.	Blezard 2	BaGn-71	L. Jackson	Rice Lake	this paper
11.	Healey Falls	BcGk-6	B. Ross	Trent River	pers.comm.
12.	Caradoc	AfHj-104	C. Ellis	Thames River	pers.comm.
AGATE BASIN *(Locations Keyed to Figure 2.4)*					
1.	Platts	Private Coll.	P. Lennox	L. Erie	Lennox 1976
2.	Strathroy	Private Coll.	E. Ellis	Sydenham R.	pers.comm.
3.	Coboconk	Kieffer Coll.	F. Richardson	Balsam Lake	this paper
HELL GAP *(Locations Keyed to Figure 2.4)*					
4.	MacDonald Ridge	AeHk-10	L. Jackson	L. Huron	this paper
5.	Blezard 2	BaGn-71	L. Jackson	Rice Lake	this paper
6.	Linton	BaGn-80	L. Jackson	Rice Lake	this paper
MADINA *(Locations Keyed to Figure 2.4)*					
7.	Cold Springs	BaGn-79	L. Jackson	Rice Lake	this paper
8.	Coates Creek	BcHa-44	G. Dibb	L. Simcoe	pers.comm.
9.	Bender	BbGt-14	G. Dibb	L. Simcoe	pers.comm.
10.	Boyington	BbGv-10	G. Dibb	L. Simcoe	pers.comm.
11.	Caldwell	Private Coll.	G. Dibb	Otonabee R.	this volume
12.	McIntyre	BbGm-6	L. Jackson	Rice Lake	this paper
EDEN-SCOTTSBLUFF *(Locations Keyed to Figure 2.4)*					
13.	Coboconk	Kieffer Coll.	F. Richardson	Balsam Lake	this paper
14.	James	BaGn-13	L. Jackson	Rice Lake	Jackson 1977
15.	Healey Falls	BcGk-6	B. Ross	Trent River	pers.comm.
16.	Gordon Island	BbGa-2	J. Wright	St. Lawrence	Wright 1979

Based on morphological similarity to the Early Palaeo-Indian Crowfield fluted point type, Ellis (personal communication, 1997) believes Holcombe to be Crowfield's immediate successor, itself followed by Hi-Lo. I suggest here that a third unfluted lanceolate type, Plainville, may also appear in the same general time frame circa 10,300 to 9,500 B.P. Holcombe points are broadly distributed in southern Ontario (Figure 2.2) and, although not numerous, do occur in the same general areas of concentration as Early Palaeo-Indian fluted points – particularly in southerly parts of southwestern Ontario (see Ellis and Deller 1990:Figure 8.9 and Jackson 1983:Figure 3).

Holcombe points are concave-based, leaf-shaped points which are relatively thin, biconvex in cross-section and generally parallel-sided. They have thin and pointed basal ears that are accentuated by deep basal concavity. Use of Onondaga and Kettle Point cherts is typical. An Onondaga chert Holcombe point found in southwestern Ontario in the 1930s is shown in Figure 2.5. Relatively few Holcombe points and sites are known in southern Ontario. However, as recently as 1998 (P. Woodley, personal communication) a Holcombe campsite known as Fowler was located just above the Algonquin (Ardtrea) strand near Barrie in south-central Ontario.

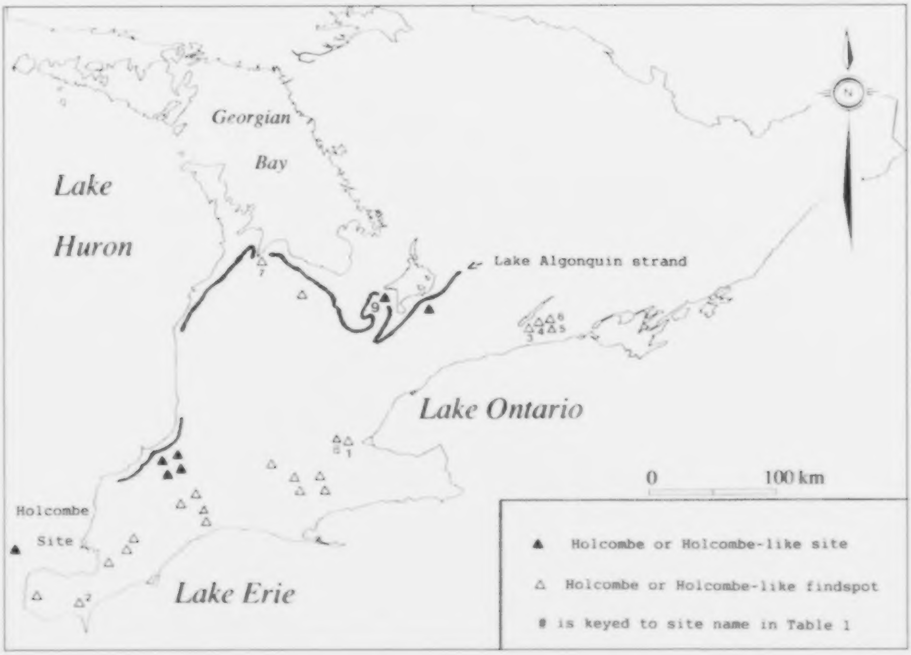

Georgian Bay
Lake Huron
Lake Algonquin strand
Lake Ontario
Lake Erie
Holcombe Site
0 100 km
N
▲ Holcombe or Holcombe-like site
△ Holcombe or Holcombe-like findspot
# is keyed to site name in Table 1

Figure 2.2 Holcombe or Holcombe-Like Points in Southern Ontario (after Ellis and Deller 1990).

Hi-Lo points are also leaf-shaped and unfluted, but with greater thickness, reduced basal concavity, and rounded basal ears. They are often extensively resharpened and hence somewhat smaller than Holcombe points. Use of Haldimand chert is quite common although examples on Onondaga and Bayport chert also occur. Figure 2.6c illustrates a concave-based Hi-Lo point from the Meadowbrook site in Ancaster, Ontario on the Niagara Escarpment.

Ellis and Deller (1990: Figure 3.17) illustrate the southwestern Ontario distribution of Hi-Lo points. Figure 2.3 in this paper, updates known finds in south-central Ontario. Hi-Lo points are broadly distributed and more commonly found in southern Ontario than Holcombe. Areas of special concentration occur in southerly parts of southwestern Ontario, and interior regions along the north shore of Lake Ontario including Hamilton-Ancaster and Oshawa-Rice Lake. These are areas of relatively intense archaeological survey in the past two decades.

Ellis (this volume) proposes division of the Hi-Lo type into two temporally significant varieties – earliest weakly stemmed and latest basally side-notched. The morphological similarity of the stemmed form to Holcombe suggests an early age while that of side-notched Hi-Lo to Early Archaic side-notched types (such as Thebes circa 9000 B.P.) supports a later age (see Jackson and Morrison 1997). Ellis recognizes a third Hi-Lo form, intermediate between Holcombe and Hi-Lo, which he calls "Hi-Ho," initially a pejorative label coined by William Roosa and myself (see Ellis, this volume).

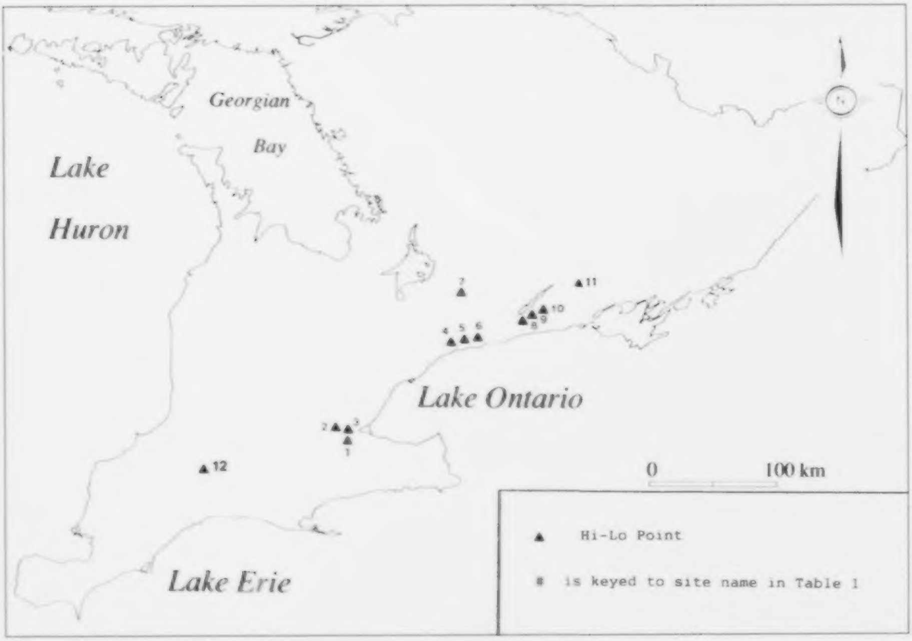

Georgian
Bay
Lake
Huron
Lake Ontario
Lake Erie
N
1
2
3
4
5
6
7
8
9
10
11
12
0
100 km
▲ Hi-Lo Point
# is keyed to site name in Table 1

Figure 2.3 New Hi-Lo Points in South-Central Ontario (see Ellis and Deller 1990:Figure 3.17).

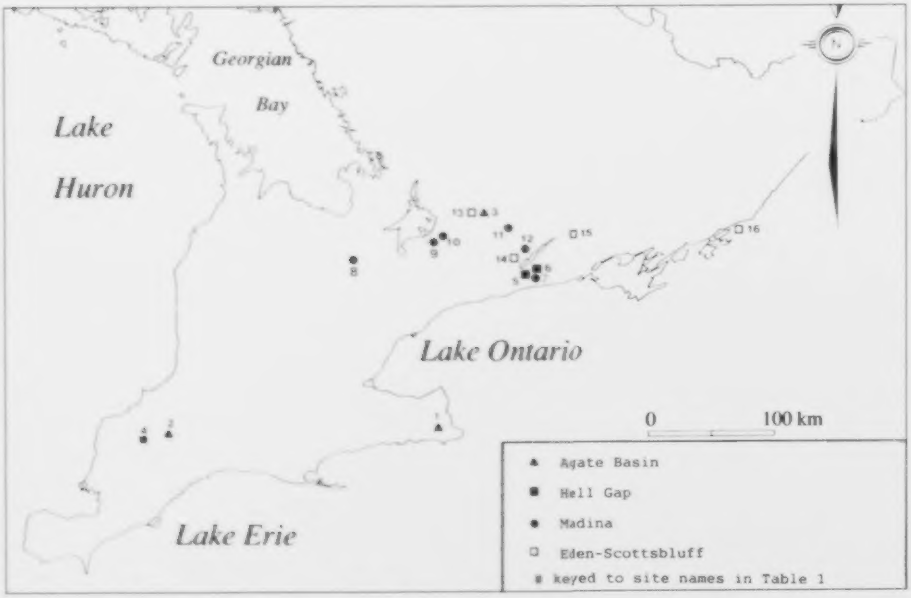

Georgian
Bay
Lake
Huron
Lake Ontario
Lake Erie
N
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
0
100 km
▲ Agate Basin
■ Hell Gap
● Madina
□ Eden-Scottsbluff
# keyed to site names in Table 1

Figure 2.4 New Finds of Other Late Palaeo-Indian Lanceolate Points in Southern Ontario (see Ellis and Deller 1990:Figure 3.17).

In addition to Holcombe and Hi-Lo, this paper recognizes a third unfluted, leaf-shaped point type called *Plainville*, which shows greatest similarity to Holcombe and may be intermediate in age between Holcombe and Hi-Lo. Examples of "Holcombe-like" points from Plainville Valley near Rice Lake in south-central Ontario originally suggested this type. It was presented at the 1995 *Thunder Bay Ontario Archaeological Society Symposium* "Late Palaeo-Indian Occupation of the Great Lakes Region." The type is now published (Jackson 1998) with additional examples cited from Flesherton and Leamington in southwestern Ontario and Ancaster and Rice Lake in south-central Ontario. Distinguishing characteristics are primarily in overall flaking patterns and basal configuration. Plainville points show a distinctly squared, well-thinned base with a straight to slightly concave basal edge, very weak basal ears, weak lateral notches 6 to 10 mm above the base, edge grinding, gentle lateral edge expansion and overall collateral flaking. Known examples are primarily on Onondaga chert but include Bayport chert and Iron Formation Manitoulin Island quartzite. Figure 2.7 illustrates a reconstructed Plainville point from Rice Lake, Ontario and shows the distribution of known type examples in southern Ontario.

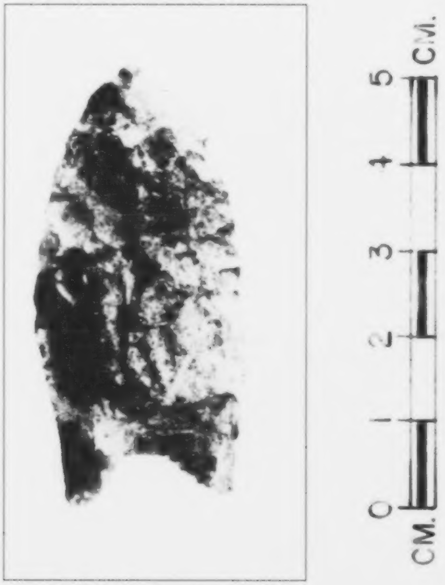


Figure 2.5 Holcombe Point from Southwestern Ontario (Courtesy of J.V. Wright, Canadian Museum of Civilization).

Agate Basin points, earliest of the Late Palaeo-Indian lanceolates in the High Plains, are long and slender with parallel or slightly convex sides. Straight to rounded at the base with lateral edge grinding, they are typically flat to biconvex in cross-section with a median ridge on one face (Roberts 1961:130). A small and widely distributed number of examples occur in southern Ontario – from the southern Huron margins to the Niagara Peninsula in southwestern Ontario and north to the Balsam Lake-Kirkfield area in south-central Ontario (Ellis and Deller 1990: Figure 3.17; Lennox 1976; and Figure 2.4, this paper). Agate Basin points are

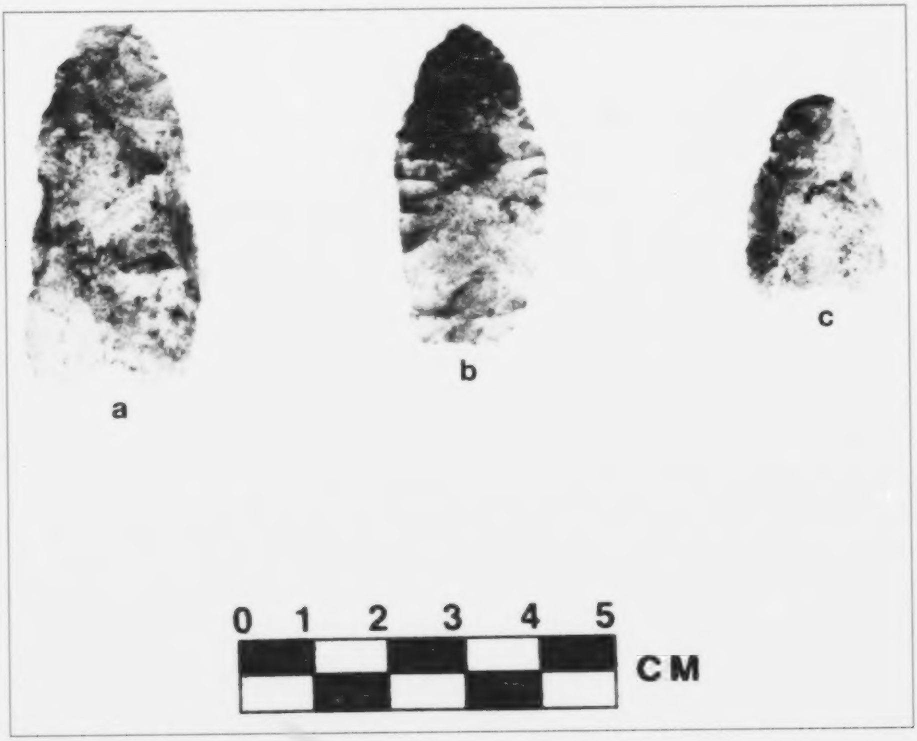


Figure 2.6 Three Late Palaeo-Indian Points from South-Central Ontario: A. Holcombe-Like Point from Seager Site (AhHa-10), Ancaster; B. Madina Point from McIntyre Site (BbGm-32), Rice Lake; C. Hi-Lo Point from Meadowbrook South Site (AhHa-22), Ancaster.

radiocarbon dated slightly before 10,000 to about 9,500 B.P. in the Plains (Agogino 1963; Frison and Stanford 1982). Figure 2.8 illustrates an Agate Basin point from Jordan Harbour on the north shore of Lake Erie.

Hell Gap points, which chronologically succeed Agate Basin in the Plains, are also rarely reported in southern Ontario. As shown in Figure 2.4, they are sparsely distributed – from the southern Huron margins in southwestern Ontario east to the Rice Lake area and north to the Lake Simcoe-Holland Marsh area in south-central Ontario. Most Ontario Hell Gap points are extensively resharpened (see Stewart 1984) and may sometimes be confused with the smaller and thinner *Madina* type of the Lake Simcoe lowlands (see Dibb 1985). Figure 2.9 shows a Hell Gap point excavated by Stewart (1984) from the Zander site south of Lake Simcoe.

Hell Gap points are long, contracting stemmed, straight-based lanceolates with heavily ground basal edges and abrupt widening of the blade above mid-point. Hell Gap points have a high ratio (0.5 or higher) of haft element to total length. In the Plains, Hell Gap is radiocarbon dated about 10,000 to 9,500 B.P., with some earlier dates recorded (Agogino 1963; Frison 1974).

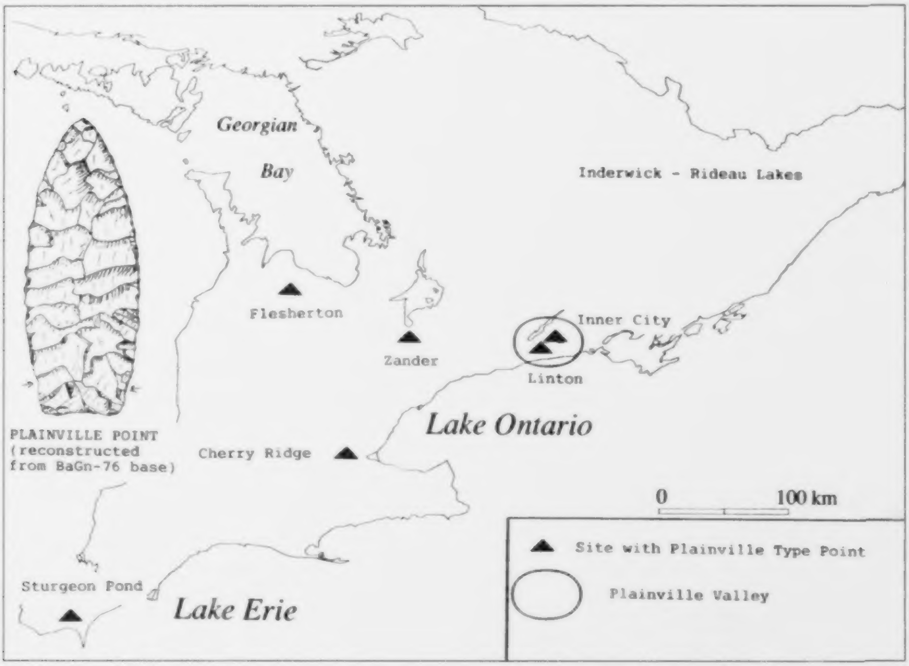
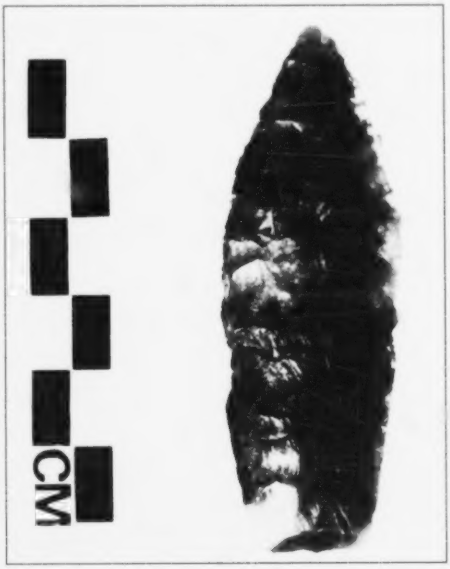

Georgian Bay
Inderwick - Rideau Lakes
Flesherton
Zander
Inner City
Linton
Lake Ontario
PLAINVILLE POINT (reconstructed from BaGn-76 base)
Cherry Ridge
0 100 km
Site with Plainville Type Point
Plainville Valley
Sturgeon Pond
Lake Erie

Figure 2.7 Southern Ontario Distribution of Plainville Points.

Madina points are small, contracting stemmed lanceolates – most often heavily resharpened. They are quite close to Hell Gap in overall morphology with straight bases and heavily ground basal edges. They differ from Hell Gap in gentler (less abrupt) and more symmetrical expansion above, and contraction below, mid-point, overall smaller size, and strong parallel flaking. Haft to length ratios (mean of 0.46) are also smaller than Hell Gap. These points are generally thin with flat to biconvex cross-sections. Dibb (this volume) illustrates a Madina point from a glacial spillway along the Otonabee River near Peterborough.

Madina points appear to be highly regionalized. Their main distribution is from the western margin of the Simcoe lowlands east to Peterborough and the southern Rice Lake region (see Figure 2.4). Examples from the southern margin of Lake Huron in southwestern Ontario occur on the bed of Lake Algonquin suggesting an age later than 10,300 B.P. (Ellis and Deller 1986). Dibb (this volume) suggests an age between 10,200 and 9,800 B.P. for Madina, commencing with the regional spruce-pine transition dated by palynological data from wetland adjoining the Deavitt site on the southeast side of Lake Simcoe. Examples of south-central Ontario Madina points are newly reported in this paper from two locations in Peterborough County north of Rice Lake, one in Plainville Valley south of Rice Lake, and a newly recognized example from the Coates Creek site (G. Dibb personal communication, 1997) southwest of Lake Simcoe (Storck 1978:Figure 2). Two quartzite lanceolates illustrated by Storck (1984:Figure 15) from the Sheguiandah site on Manitoulin Island may also be Madina.

Figure 2.8 Agate Basin Point from Jordan Harbour Site, Niagara Peninsula (Courtesy of Paul Lennox).



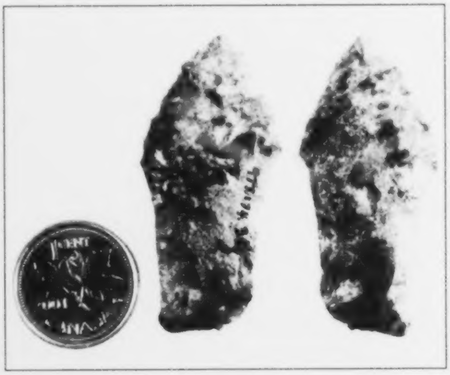


Figure 2.9 Obverse and Reverse Views of Hell Gap Point from Zander Site, Holland Marsh (Courtesy of Andrew Stewart and Royal Ontario Museum).

Finally, *Eden-Scottsbluff* points are thin, elongated triangular, straight-edged, straight-based and narrow lanceolates with highly distinctive parallel flaking. This combined type name is something of a misnomer since the closest similarity of the Ontario examples is with the so-called "parallel lanceolates" best known from Maine and the East Coast. Doyle *et al.* (1985) note a radiocarbon date of about 9,500 B.P. for parallel lanceolates from Squaw Rockshelter, Ohio. The Ontario points referred to as Eden-Scottsbluff are elongated, isosceles triangle shaped, parallel lanceolates with distinctive collateral flaking and basal edge grinding. A complete example found near Coboconk at the northeast tip of Balsam Lake in south-central Ontario is shown in Figure 2.10. Rarely found in southern Ontario, parallel lanceolates are restricted in distribution primarily to the eastern parts of the province – particularly along the Trent and St. Lawrence waterways and eastward into southern Quebec and

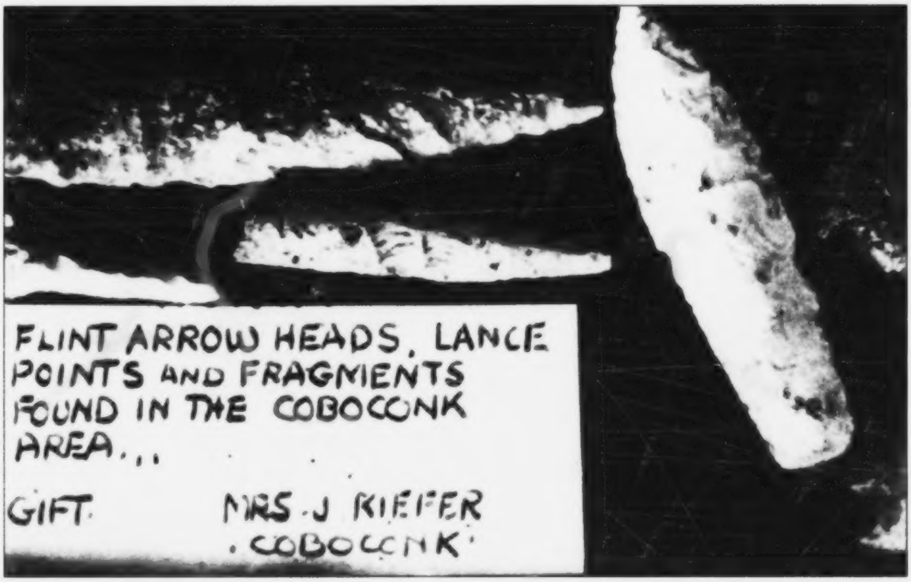


Figure 2.10 Agate Basin and Eden-Scottsbluff-Like Points Found Near Coboconk, Ontario (Courtesy of Richard Johnston).

northern Maine. An age of about 9,800 to 9,500 B.P., comparable to Eden-Scottsbluff in the Plains, might be suggested.

Suggested Chronological Sequence For Southern Ontario

Broad temporal placement of Late Palaeo-Indian points in southern Ontario is possible based on morphological continuity of Holcombe with earlier Palaeo-Indian fluted forms, on the similarity of side-notched Hi-Lo to other Early Archaic side-notched forms, and on radiocarbon dates for Agate Basin and Hell Gap in the Plains. Holcombe, essentially an unfluted Crowfield point, likely dates shortly after 10,300 B.P. at the end of Lake Algonquin when Crowfield disappears. Holcombe-like or Plainville points likely fit somewhere between Holcombe and Hi-Lo and possibly even between Crowfield and Holcombe – much like Midland/Plainview in the Plains. Earliest Hi-Lo shows continuity with Holcombe while the side-notched variety overlaps with the later Early Archaic side-notched horizon circa 9,500 B.P. Madina may date around 10,200 to 9,800 B.P. and the parallel lanceolates circa 9,500 B.P. Agate Basin and Hell Gap, as already noted, date in the period 10,000 to 9,500 B.P. with a few earlier dates on Agate Basin.

There is some suggestion from mapped southern Ontario occurrences that unstemmed and contracting stemmed lanceolates, such as Agate Basin, Hell Gap, and Madina, have a more northerly distribution in southwestern and south-central Ontario. However, there are also clear exceptions to this distributional pattern, which may reflect either range overlap with more explicitly southern forms such as Holcombe and Hi-Lo or the incompleteness of sampling.

The seven known types of Late Palaeo-Indian points in southern Ontario may represent a time series – perhaps with spatial overlap of northern groups ranging southward and southern groups ranging north (Ellis and Deller 1990). Southern groups may include Holcombe and Plainville (Holcombe-like) and three varieties of Hi-Lo (Hi-Ho, stemmed, and side-notched Hi-Lo in that order of appearance) circa 10,000 to 9,500 B.P. Northern groups may include Agate Basin circa 10,300 to 10,000 B.P., Hell Gap circa 10,000 to 9,500 B.P., and Madina in the same general period circa 10,200 to 9,800 B.P. Madina could also be a regional type specific to south-central Ontario. Finally, Eden-Scottsbluff or, more properly, parallel lanceolates appear to be an eastern type (St. Lawrence River centered), occasionally found along waterways in south-central Ontario. These types may date circa 9,500 B.P. as at the Squaw Rockshelter in Ohio.

Sampling Bias

Comparison of Figures 2.2 through 2.4 with the distributional maps of Ellis and Deller (1990) shows a marked increase in the reporting of Late Palaeo-Indian points in southern Ontario. This corresponds, in large degree, to archaeological assessments in advance of development and is especially noteworthy in the reporting of Hi-Lo points along the north shore of Lake Ontario.

New Late Palaeo-Indian finds continue to be made in areas of long-term research by specific archaeologists – Deller and Ellis in the Sydenham River drainage of southwestern Ontario, Dibb in the Lake Simcoe lowlands, Jackson in the Rice Lake basin of south-central Ontario, and Storck in the Blue Mountain area of the Niagara Escarpment. Overall, much of southern Ontario has not seen intensive survey coverage of this nature so that Late Palaeo-Indian finds appear sporadically rather than as a part of systematic settlement pattern surveys.

Shoreline Submergence

There is good reason to believe that a sizable number of Late Palaeo-Indian sites in southern Ontario are covered by the modern lakes Huron, Erie and Ontario. Jackson *et al.* (2000) have discussed in detail changing water levels in these three basins, documenting low water stands in the Early and Late Palaeo-Indian periods. As shown in Figure 2.11, as much as 25% of the southern Ontario land mass bordering the modern basins of Lakes Huron, Erie, and Ontario has been inundated since the Late Palaeo-Indian period. The Erie and Ontario basins continued to rise for more than 1,000 years after the draining of Lake Algonquin and closing of its outlet by isostatic rebound. Since southern Ontario was dominated by closed jack-pine forests during this period and since strandline occupation continued to be important to Late Palaeo-Indian hunter-gatherers, at least in northern Ontario, these now inundated southern Ontario lake strands probably contain significant missing site data.

Recent interpretation suggests that Main Lake Algonquin only reached a level 150 feet below the modern level of Lake Huron (Kaszycki 1985) and that Early Palaeo-Indian sites on the so-called Algonquin strand are actually on an upper level Ardtrea beach (Jackson *et al.* 2000). By the time of Late Palaeo-Indian occupation after 10,300 B.P., Huron basin low level lakes Stanley and Hough occupied only the deepest parts of the basin, with massive former lake plain areas – as much as 12,000 to 14,000 square km, exposed as dry land along the Ontario side of modern Lake Huron. Similarly, the Erie and Ontario basins experienced significant low stages. The Erie basin held several smaller lakes, dammed by glacial end moraines. The western, central and eastern basins likely contained separate lakes until after 10,000 B.P. from 50 to 85 feet below modern levels (Coakley and Lewis 1985). An area of about 10,000 to 12,000 square km was exposed along the Ontario side of Lake Erie during the Late Palaeo-Indian period. Fully half the land surface today under Lake Erie was actually exposed.

Continual infilling of deep basins after 10,000 B.P. led to constant rise of Lake Erie – with two major exceptions: 1) the Nipissing transgression of about 5,500 B.P. and 2) the glacial Lake Agassiz discharge of about 11,000 to 10,500 B.P. – both of which flooded the Erie basin above modern levels (Tinkler *et al.* 1992). Pengelly and Tinkler (this volume) discuss specific human impacts of such catastrophic discharges into the Erie basin.

During the Early Palaeo-Indian period, circa 11,300 to 10,300 B.P., Ontario basin waters were also continuously rising. As the St. Lawrence outlet deglaciated, a series of low level lakes formed in the Ontario basin. These descending lakes included Iroquois, Frontenac, Sydney, Belleville and Trenton until sill control shifted to the Hudson Valley and more rapid draining commenced. After the end of Lake Algonquin (Ardtrea) in the Huron basin and opening of the North Bay outlet about 10,000 B.P., the rate of level increases moderated. There was not another rapid rise until 9,400 B.P. (Coakley and Karrow 1994). An area of perhaps 4,000 to 6,000 square km was exposed along the north shore of the Ontario basin *early* in the Late Palaeo-Indian period but was largely gone by the time of the rapid rise at 9,400 B.P.

Lake levels were not only significantly lower along the Huron, Erie, and Ontario basin shorelines during the Late Palaeo-Indian period but they were also dynamic. Catastrophic flood events such as the Lake Agassiz discharge surely scoured much site evidence, as did the mid-Holocene Nipissing transgression. The results of shoreline erosion as lakes rose, shifting drainage as new outlets were uncovered, and episodic floods clearly would have damaged or even buried much evidence of shoreline sites. Different periods and areas of Late Palaeo-Indian occupation would have seen quite different conditions and shorelines, despite flow linkages between the main basins. Isostatic uplift also differentially flooded the southern Huron and western Erie and Ontario basins over time – slowly pushing shorelines inland during the Late Palaeo-Indian period.

In summary, we can state with confidence that a substantial population of Late Palaeo-Indian sites was destroyed by dynamic lake environments, that a sizable number of sites are now under water in areas once dry land, even that some former river mouth or delta sites are now deeply buried by shifting sedimentation, and that current knowledge of Late Palaeo-Indian settlement systems in the Great Lakes region is severely truncated.

Although no systematic searches in offshore environments have yet confirmed this prediction, the occurrence of waterworn artifacts at the Heaman site below the Lake Algonquin

(Ardtrea) strand demonstrates occupation of lake-edge environments by Late Palaeo-Indian groups using Agate Basin and Madina points. Deller and Ellis (1986) record other waterworn assemblages in the southeastern Huron basin area and current work by Janusas *et al.* (this volume) is beginning to map the submerged environments of the Huron basin where such evidence may occur.

Projectile Point Distributional Patterns

What can distributional studies tell us about Late Palaeo-Indian occupations in southern Ontario? Since there are no dated Palaeo-Indian sites in Ontario and very few geochronological markers, the distribution of point types dated in other regions (such as the Plains) is our primary clue to the nature, extent, and sequence of occupations. Radiocarbon dating of Lakehead Complex sites in northern Ontario to as early as perhaps 9,000 B.P. and the presumed first appearance of other Late Palaeo-Indian types immediately after the disappearance of fluted points in southern Ontario about 10,300 B.P., documents a likely span of at least 1,000 years for Late Palaeo-Indian occupation throughout Ontario and perhaps closer to 1,500 years when radiocarbon dates for Agate Basin and Hell Gap in the Plains are taken into account.

There are at least 24 Holcombe sites or findspot records in southern Ontario. Most of these are in southwestern Ontario in a southerly distribution, a small number in south-central and none in southeastern Ontario. There is a strong interior distribution in addition to finds associated with the Algonquin (Ardtrea) strand. Hi-Lo points from sites and findspots are much more common. Clusters occur on the south shore of Lake Simcoe, near Rice Lake in south-central Ontario, and near the Thedford Marsh area in southwestern Ontario. Significantly, these are all areas of intensive regional survey by Palaeo-Indian researchers: Deller and Ellis in the Thedford Marsh area, G. Dibb in the Lake Simcoe area, L. Jackson and A. Roberts in the Rice Lake area and north shore of Lake Ontario, and P. Storck in the Blue Mountain area near Georgian Bay.

As the presumed earliest Late Palaeo-Indian type, at a time when Great Lakes levels are just beginning to rise, Holcombe may have had the *largest* original territory in southern Ontario and also the greatest truncation of site records by flooding. Hi-Lo points show a much-expanded but parallel distribution with focus in areas of intense Palaeo-Indian research. Agate Basin and Hell Gap show a very weak distribution, perhaps reflecting an age comparable to Holcombe with the inundation of a large population of sites or perhaps a later age and northern Ontario emphasis. Significantly, both Madina and Eden-Scottsbluff appear to be regionalized types, the former in south-central and the latter in eastern Ontario.

There are at least two significant sampling biases affecting our interpretation of the southern Ontario record – truncation caused by flooded land masses (former lake plains) and archaeological sampling bias resulting from the regional focus of key researchers. A simple test of both of these biases is provided by discussion of intensive survey of one small interior valley south of Rice Lake in south-central Ontario. Plainville Valley has probably seen the most area intensive survey coverage of any physiographic feature in Ontario and is *not associated with, or affected by, shoreline submergence* after the Late Palaeo-Indian period (Jackson 1997).

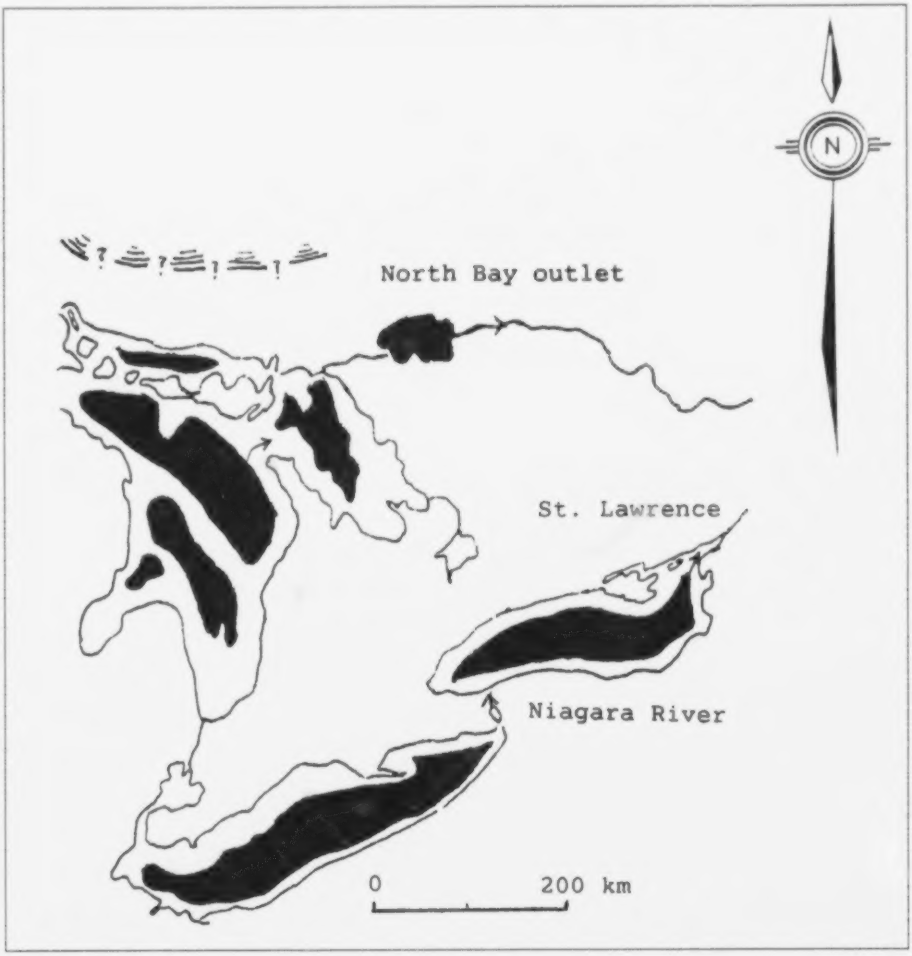


Figure 2.11 Great Lakes Levels Circa 10,000 B.P. (After Larsen 1987:Figure18).

Plainville Valley Survey

Intensive survey of a 200 square km area in the southwestern Rice Lake region of south-central Ontario (Figure 2.12) during the mid-1980s yielded valuable information on Gainey phase Early Palaeo-Indian occupation circa 11,000 B.P. (Jackson 1997). Complete survey cov erage of about 25% of total land surface area produced a strong picture of systems of small exploitation sites spread across interior landscapes. A similar pattern was discovered for the Late Palaeo-Indian period in Plainville Valley–a major land feature within the survey area.

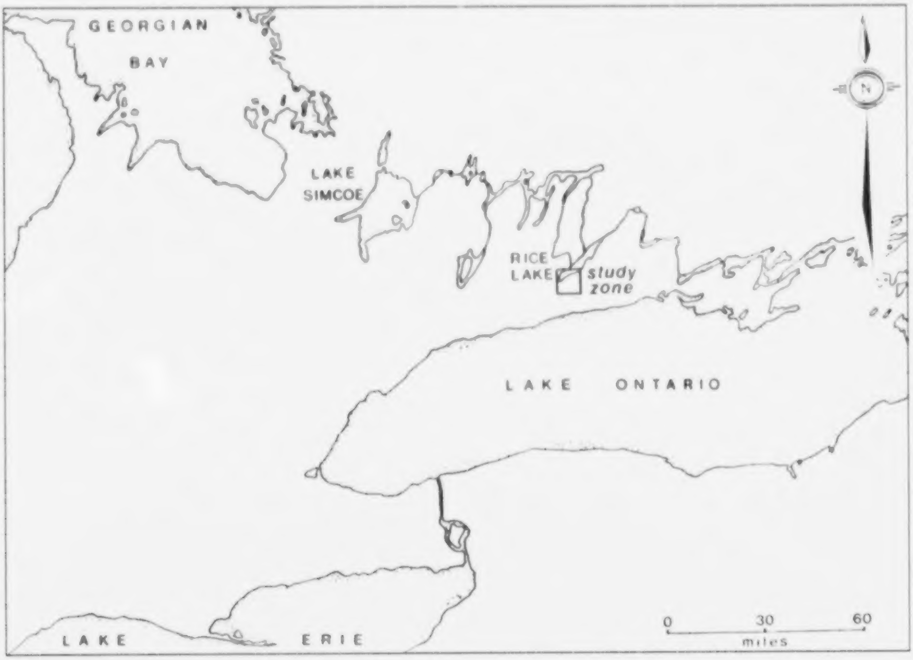

GEORGIAN BAY
LAKE SIMCOE
RICE LAKE
study zone
LAKE ONTARIO
LAKE ERIE
N
0
30
60
miles

Figure 2.12 Location of Rice Lake Study Zone in South-Central Ontario.

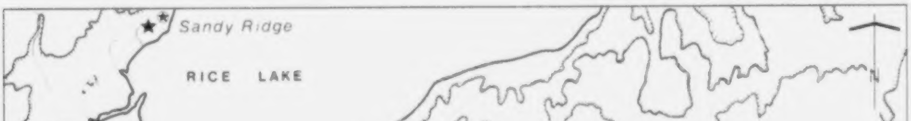

Sandy Ridge
RICE LAKE
RIDGE AND PLATEAU
900
Desroches
700
Halstead
900
Linton
Alderton
800
Inner City
Blezard 1,2
Buttar
STREAM VALLEY
Dune 28
RIDGE AND PLATEAU
1000
Cold Springs
BASIN
Bebee
Marshman
900
800
700
SADDLE
800
700
PALAEO-INDIAN
EARLY ARCHAIC
700
0
1
2
km
N

Figure 2.13 Palaeo-Indian and Early Archaic Sites of Plainville Valley and Rice Lake.

1984 and 1985 survey of this small, east-west oriented valley just south of Rice Lake covered about 50% of the valley floor in an area of about 50 square km. Surface recoveries of diagnostic projectile points from eight small sites in the valley documented a varied and continuous Late Palaeo-Indian use. All eight sites also produced a diverse array of Early, Middle, and Late Archaic, as well as Early and Middle Woodland projectile points in locations that support short-term camps and kill sites.

Figure 2.13 shows Palaeo-Indian and Early Archaic site locations in Plainville Valley. Seven Late Palaeo-Indian sites follow the course of Plainville Stream which flows from the northeast, east-west through the Valley, and drains to Rice Lake in the northwest (see Figure 2.14). All seven sites are strategically situated along terraces or knolls which front on the stream, or pond widenings in the stream, fed by springs (as at the Linton and Buttar sites). One site, Cold Springs, is located on the high Oak Ridges Interlobate Moraine, to the south, which overlooks the valley floor and has a clear view of both Rice Lake to the north and Lake Ontario to the south.

Figure 2.15 provides an aerial view to the east of part of Plainville Valley. Surface finds of Late Palaeo-Indian materials are indicated by arrows. All finds are on the south side (right of

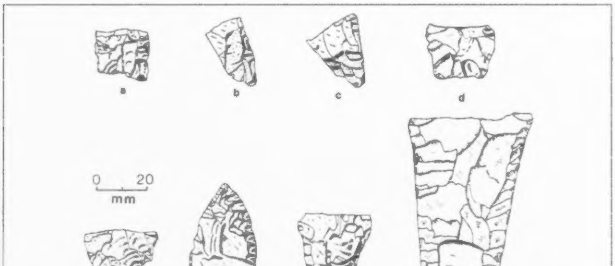


Figure 2.14 Late Palaeo-Indian Points from Sites in Plainville Valley.

photo) of the stream which bisects the landscape in the photo. Locations 1 and 2 mark recoveries of Holcombe point bases at the Buttar site, location 3 a Hi-Lo point at Blezard 1, and location 4 a Hell Gap point at the Blezard 2 site. Figure 2.16 shows an aerial view to the north of the Linton site, a T-stream intersection hunting ambush site. Location 1 produced a very large Hell Gap point mid-section on a sandy knoll overlooking the south side of the T-intersection and location 2 a Plainville (Holcombe-like) point base on Bayport chert north of the T-intersection. The Inner City Angels site, 200 metres southeast of the Linton site, also produced a Plainville (Holcombe-like) point base on Onondaga chert. The Inner City Angels site is on a small knoll set well back from Plainville Stream, unlike Linton, which borders the stream. The Bebee site at the west end of Plainville Valley yielded a small Hi-Lo stemmed point. Finally, the Cold Springs and Alderton sites each yielded a Balsam Lake chert lanceolate point tip section. Both sites are on the crest of the Oak Ridges Moraine overlooking Plainville Valley to the north. Balsam Lake chert is a preferred Late Palaeo-Indian material in south-central Ontario, rarely used on other period sites (Dibb, this volume).

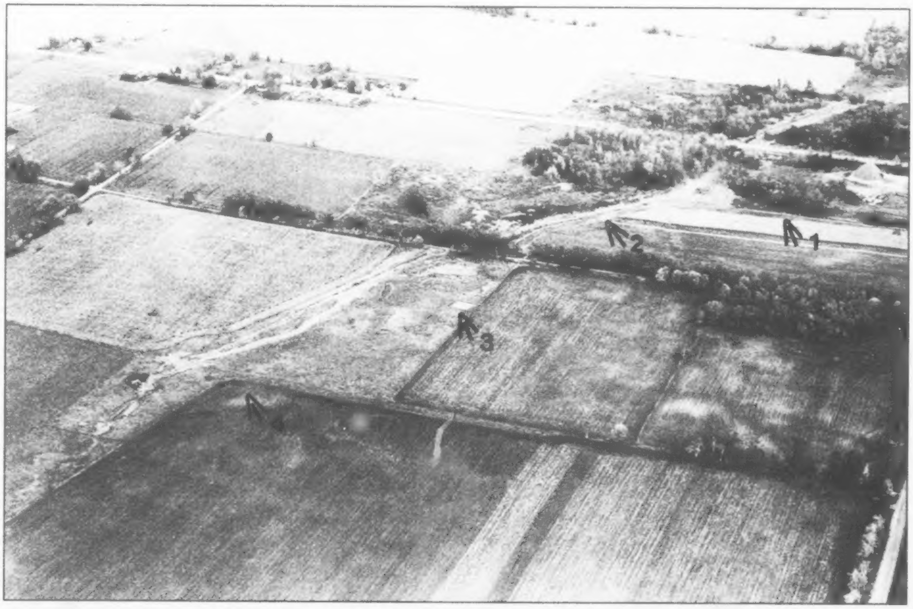


Figure 2.15 Aerial View to Northeast of Blezard 1 (BaGn-71), Blezard 2 (BaGn-72), and Buttar (BaGn-70) Sites, Plainville Valley Showing Diagnostic Point Locations: 1. Holcombe Point, BaGn-70 2. Holcombe Point, BaGn-70; 3. Hi-Lo Point, BaGn-71; 4. Hell Gap Point, BaGn-72.

photo) of the stream which bisects the landscape in the photo. Locations 1 and 2 mark recoveries of Holcombe point bases at the Buttar site, location 3 a Hi-Lo point at Blezard 1, and location 4 a Hell Gap point at the Blezard 2 site. Figure 2.16 shows an aerial view to the north of the Linton site, a T-stream intersection hunting ambush site. Location 1 produced a very large Hell Gap point mid-section on a sandy knoll overlooking the south side of the T-intersection and location 2 a Plainville (Holcombe-like) point base on Bayport chert north of the T-intersection. The Inner City Angels site, 200 metres southeast of the Linton site, also produced a Plainville (Holcombe-like) point base on Onondaga chert. The Inner City Angels site is on a small knoll set well back from Plainville Stream, unlike Linton, which borders the stream. The Bebee site at the west end of Plainville Valley yielded a small Hi-Lo stemmed point. Finally, the Cold Springs and Alderton sites each yielded a Balsam Lake chert lanceolate point tip section. Both sites are on the crest of the Oak Ridges Moraine overlooking Plainville Valley to the north. Balsam Lake chert is a preferred Late Palaeo-Indian material in south-central Ontario, rarely used on other period sites (Dibb, this volume).

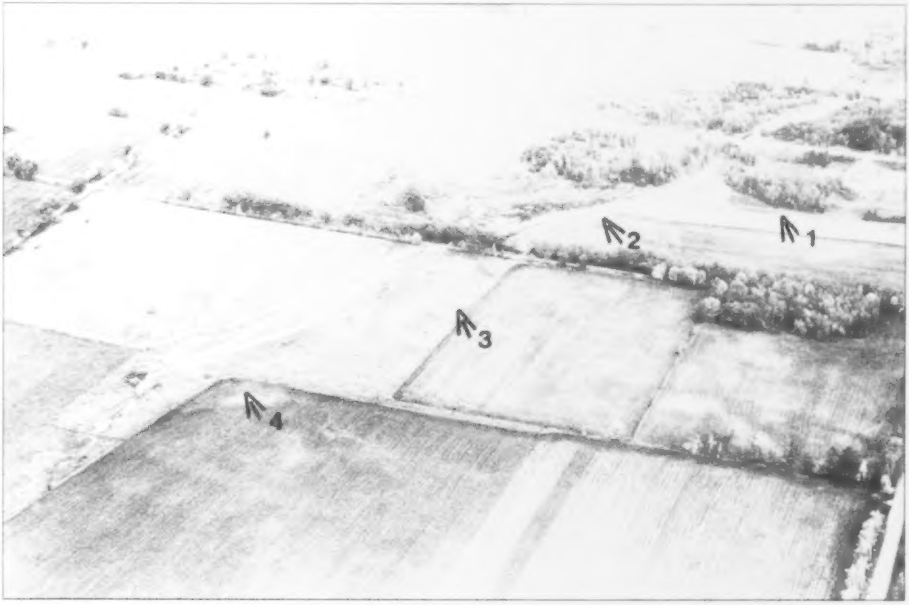


Figure 2.15 Aerial View to Northeast of Blezard 1 (BaGn-71), Blezard 2 (BaGn-72), and Buttar (BaGn-70) Sites, Plainville Valley Showing Diagnostic Point Locations: 1. Holcombe Point, BaGn-70 2. Holcombe Point, BaGn-70; 3. Hi-Lo Point, BaGn-71; 4. Hell Gap Point, BaGn-72.

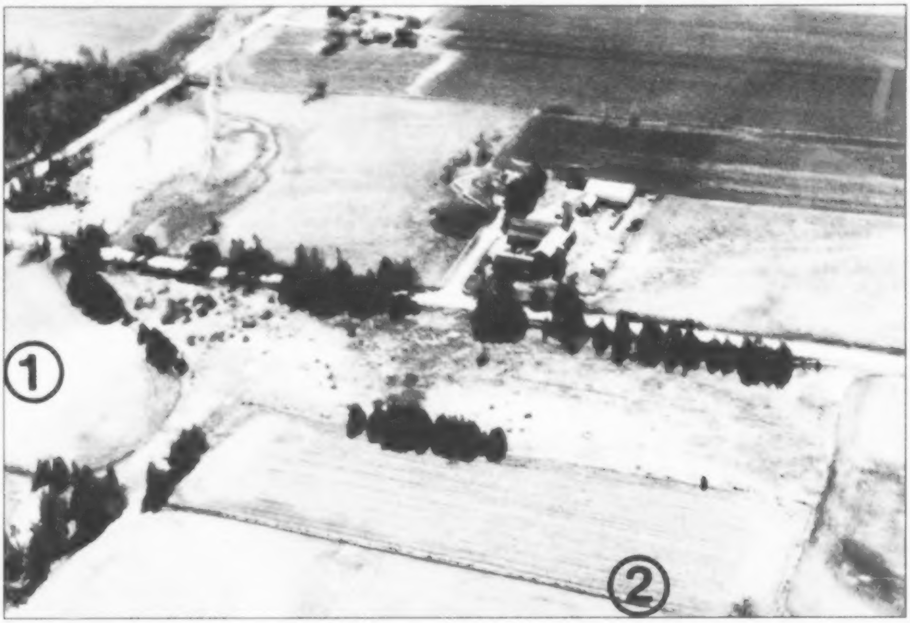


Figure 2.16 Aerial View to East of Locations 1 and 2 at the Linton Site (BaGn-80) Bordering T-Stream Intersection.

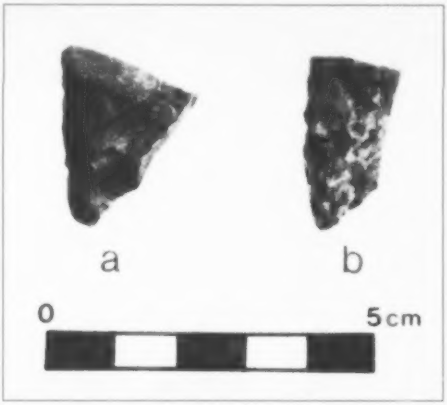
Plainville Valley Projectile Points

Holcombe

BLEZARD 2 AND BUTTAR SITES: *Figures* 2.2 *and* 2.17. Holcombe points in Ontario are described as Crowfield-like lanceolates which lack fluting. Maximum blade width is at, or above mid-point, flaking is shallow and parallel to collateral and crosses the mid-line of the point face, basal concavity is shaped by unifacial retouch, and there is light grinding on basal edges. Measurements for Ontario Holcombe points are 34 to 68 mm length, 16 to 26 mm width, 3 to 7 mm thickness, 18 to 27 mm basal width, and base thinning scar length of 4 to 28 mm. Raw material includes Onondaga and Kettle Point, Ontario, Bayport and Upper Mercer, Michigan and Ten Mile Creek, Ohio cherts (Ellis 1986; Fitting *et al.* 1966).

Two Holcombe points were recovered from Plainville Valley–one from Blezard 2 and one from the Buttar site. Ellis and Deller (1990: Table 3) refer to these two points as Holcombe-like. Each is a basal corner, which includes the ear, part of the basal concavity, and a short length of the lateral edge. Both are made from Onondaga chert. Both are plano-convex in cross-section and show shallow, parallel to collateral flaking, and light basal edge grinding. Measurements are 28.5 and 29.2 mm incomplete length, 15.0 and 22.2 mm incomplete width, 4.2 and 5.4 mm thickness, 2.72 and 2.29 grams weight, and each point with single

Figure 2.17 Two Holcombe Point Bases on Onondaga Chert from Buttar Site (BaGn-72).



basal thinning scars of 18.8 and 9.5 mm length, respectively. Morphological traits, raw material, thickness, and basal treatment all conform to Holcombe (see Fitting *et al.* 1966).

Holcombe points are believed to post-date the end of glacial Lake Algonquin circa 10,300 B.P. and to succeed Crowfield fluted points. No examples are known from dated or stratified contexts. In addition to morphological similarities to the Crowfield type, use of Upper Mercer and Bayport cherts shows continuity with Early Palaeo-Indian raw material preferences. Ellis (1986) suggests the similarity of Holcombe points to Midland/Plainview points of the Late Palaeo-Indian period in the Plains and Southwest.

Plainville

INNER CITY AND LINTON SITE: *Figures 2.2 and 2.18.* Two unusual lanceolate point bases were found in Plainville Valley – one from the Inner City site on Onondaga chert and one at the Linton site on Onondaga chert. These two point bases are close to Holcombe in general morphology and are defined as a newly-recognized type called Plainville (Jackson 1988:23–25).

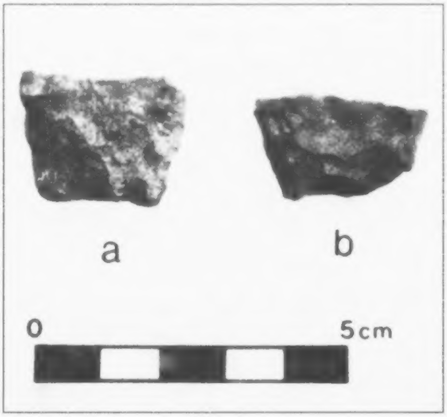


Figure 2.18 Two Plainville Point Bases on a) Onondaga Chert from the Inner City Angels Site (BaGn-76) and b) on Bayport Chert from the Linton Site (BaGn-80).

The Onondaga chert base from the Inner City site is small, broad, thin, and snapped at mid-point. It shows both Holcombe and Hi-Lo characteristics. It has an incomplete length of 22.3 mm, blade width of 31.8 mm, basal width of 19.4 mm, thickness of 4.7 mm, and weighs 3.53 grams. There is marked lateral edge expansion from the base. The base itself is squared with straight to gently incurving sides, two weak and thin basal ears, and light grinding. Cross-section is plano-convex but off-center like a Hi-Lo point with greatest thickness at mid-point. Total length is estimated between 48 and 54 mm. There is a characteristic bilateral edge indentation 5 to 7 mm above the base. Flaking is collateral and basal thinning is by unifacial retouch of the base on each face.

The weathered Bayport chert base from the Linton site is ruby red in exterior colour and caramel brown on the interior as shown where the point is snapped above the base. This is a small, broad, thin and squared base point. Its incomplete length is 18.0 mm, width at the snap 29.8 mm, basal width 22.8 mm, thickness 4.9 mm, and weight 3.16 grams. It is markedly excurvate with weak lateral indentations 6 mm above the base on one side and 4 mm on the other. Perhaps due to a flaking accident, one basal edge is lower and lacks an ear. The opposing basal corner has a very thin and weakly defined ear. The point is plano-convex to biconvex in cross-section with an estimated length of 50 to 60 mm. Flaking tends to be collateral but is not consistent (like a Hi-Lo point) and basal thinning is by poorly controlled unifacial retouch of each face. The basal edge is straight to slightly incurvate.

The two Plainville points show more similarity to the Holcombe type than to Hi-Lo. They are both within the length and basal width range of Holcombe. Unifacial retouch also shapes the bases, as with Holcombe. Cross-sections are plano-convex to bi-convex, also like Holcombe points, and both fall within the Holcombe thickness range. Use of Bayport chert also suggests continuity with Holcombe and an early age. Very similar excurvate lanceolate points are described from the McConnell site in Ohio (Prufer 1963) and Graveyard Point, Maine (Doyle *et al.* 1985). Although the two Plainville points are also within the general length and width range for Hi-Lo type points, there are at least four areas of pronounced difference. Plainville points are not as thick as Hi-Lo, they do not show distinct and thick basal ears, basal thinning is not executed by one or more parallel-sided flakes, and bases are not concave like either Hi-Lo or Holcombe. Squared basal configuration and gently curved edge expansion on Plainville points is similar to western Plainview and even Midland points.

The Plainville points do not share several ubiquitous Hi-Lo traits, as described by Ellis, including overall thickness and the presence of knobby basal ears. They appear much closer morphologically to Holcombe points but lack Holcombe's distinctive basal concavity and thinning attributes. Other Plainville points are known from Sturgeon Pond in southwestern Ontario (Lennox personal communication, 1997) and the Cherry Ridge site in south-central Ontario (R. Griffin-Short personal communication, 1997) (see Figure 2.2). Plainville points may fit best morphologically and temporally between Crowfield and Holcombe or perhaps Holcombe and Hi-Lo. They are definitely different from the intermediate Hi-Ho type proposed by Ellis (this volume).

Hi-Lo

BLEZARD 1, BLEZARD 2, AND BEBEE SITES: *Figures 2.3 and 2.19.* Hi-Lo points in southern Ontario are believed to develop directly out of Holcombe. This is based on a series of morphological and metrical traits described by Ellis and Deller (1990). These are thick, concave-based, heavily resharpened lanceolate points with distinct, thick basal ears giving a "fishtail" appearance. There is considerable variability within the Hi-Lo type, which results from both extensive resharpening and morphological change over time. Traits such as heavy lateral and basal edge grinding and thinning by one or more parallel-sided flakes mirror Southeastern Dalton Late Palaeo-Indian points. Dalton-like alternate edge bevelling as a result of resharpening is a common Hi-Lo attribute. Plano-convex to biconvex cross-sections predominate and raw materials include Onondaga, Haldimand, and Kettle Point chert.

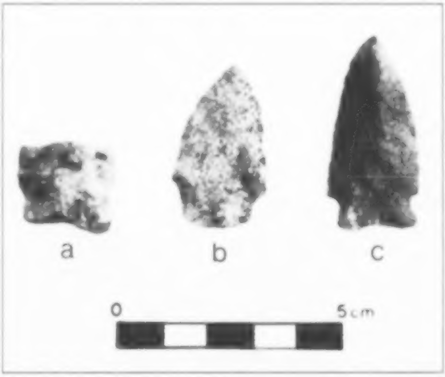


Figure 2.19 Three Varieties of Hi-Lo Points on a) Haldimand Chert from the Blezard 1 Site (BaGn-70), on b) Haldimand Chert from the Bebee Site (BaGn-66), and c) on Onondaga Chert from the Blezard 2 Site (BaGn-71).

Ellis (this volume) proposes two varieties of one Hi-Lo type (Classic Stemmed and Side-Notched) and a second type, the pejoratively designated Hi-Ho point, intermediate between Holcombe and Hi-Lo. The Hi-Lo point is ubiquitous in southern Ontario, with over 75 known locations, and is increasingly recognized in south-central Ontario (this paper). As noted by Ellis (1981), Hi-Lo points in Ontario range between 26 and 59 mm in length, 18 to 29.5 mm in width, and 6.5 to 11.0 mm in thickness.

Three Hi-Lo points are recorded from Plainville Valley, two of them stemmed and one side-notched. A point base made from Haldimand chert and excavated at the Blezard 1 site conforms nicely to the Classic Stemmed Hi-Lo description. It is snapped just above mid-point with a preserved length of 20.2 mm and estimated length of 42 to 46 mm. It is 22.1 mm wide and 6.3 mm thick, with basal width of 20.1 mm and weight of 2.72 grams. Length and width fall within the Hi-Lo type range while thickness is slightly below normal. However, since Hi-Lo points show greatest thickness at mid-point, broken away on this specimen, thickness may also conform. The Blezard 1 point is resharpened, with an asymmetric "twisted parallelogram" cross-section which results from alternate edge bevelling, a common trait on Hi-Lo points. A single basal thinning flake on one face is 13.2 mm long, 5.2 mm wide, and parallel-sided – all typical of Hi-Lo.

A second stemmed Hi-Lo point, on Haldimand chert, was found at the Bebee site at the west end and widening of Plainville Valley where it enters Rice Lake. This is an isolated surface find from a knoll near a creek. The point is shouldered or stemmed with weak lateral indentations, 10.8 mm above the base on one side and 7.4 mm on the other. Basal thinning on one face shows short, parallel-sided flakes about 9 to 10 mm up the point. The basal edge is straight to slightly concave and blade edges are gently excurvate. Basal ears are very weakly defined. Cross-section is plano-convex to bi-convex and slightly off-center due to bevelling of one lateral edge. With a length of 38.4 mm, width of 21.8 mm, thickness of 7.2 mm, basal width of 15.5 mm, and weight of 5.72 grams, this point falls within the Hi-Lo type range and is closest to the early Classic Stemmed type proposed by Ellis (this volume).

A finely-fashioned side-notched point on an asymmetrical Onondaga chert flake found on a knoll overlooking Plainville Stream at the Blezard 2 site conforms to the late Side-Notched Hi-Lo type described by Ellis (this volume). The Blezard 2 specimen shows a very distinct basal concavity, well-defined basal ears, strong but shallow notches 8.2 and 9.1 mm above the basal corners, basal thinning by a single broad flake, and unifacial retouch of basal margins on both faces. This point is asymmetrically plano-convex to biconvex in cross-section with slight bevelling of one lateral edge. Blade edges are straight to slightly excurvate. The point is 45.0 mm long, 21.7 mm wide, and 6.3 mm thick, with a basal width of 19.0 mm and weight of 5.56 grams. It falls within the range of Hi-Lo points with notching and blade serration comparable to other early Archaic point types.

Hi-Lo points, first known from the Hi-Lo site in Michigan (Fitting *et al.* 1966), are believed to date sometime after about 10,300 and before 9,500 B.P. There is general agreement that stylistic attributes place Hi-Lo somewhat later than Holcombe which may itself date between 10,300 and 10,000 B.P. Hi-Lo points have a scattered distribution along the north shore of Lake Ontario, including interior Plainville Valley, and are well known through southwestern Ontario.

Hell Gap

BLEZARD 2, LINTON SITES: *Figures 2.4 and 2.20.* Two Hell Gap points are known from Plainville Valley, both midsections on Onondaga chert and both snapped just above midpoint and also across the stem. The smaller example is from Blezard 2 and the larger from the Linton site.

Hell Gap points are contracting stemmed lanceolates with a very distinctive blade widening above mid-point. They differ from earlier Agate Basin points, primarily in haft treatment. Agogino (1961) defined Hell Gap as reminiscent of Agate Basin but with marked basal constriction, straight or slightly convex base, thin oval to diamond-shaped cross-section, heavy edge grinding along the constricted base portion, and with a length range of 60 to 80 mm. Pronounced outflaring at the shoulder (at or above mid-point) and rounding of the tip are characteristic. Irwin-Williams *et al.* (1973) also see Hell Gap as a stylistic development out of earlier forms such as Agate Basin with a shift in proportion and treatment of the haft.

The two Plainville Valley Hell Gap points can be reconstructed based on distinctive midpoint widening and basal constriction. The smaller Blezard 2 specimen has an incomplete length of 27.8 mm, width of 29.2 mm, thickness of 5.5 mm and weight of 5.16 grams. The Linton mid-section is 71.1 mm long (incomplete), 48.0 mm wide, 10.6 mm thick, and weighs

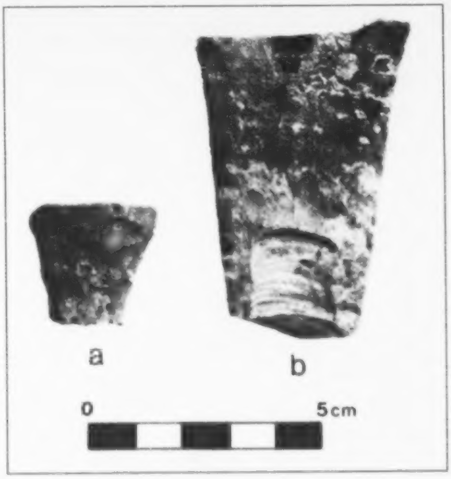


Figure 2.20 Two Hell Gap Points on Onondaga Chert from a) the Blezard 2 (BaGn-71) and b) the Linton Site (BaGn-80).

32.92 grams. Both points show oblique to parallel flaking with continuous marginal retouch and are lenticular in cross-section. The Blezard 2 point has a projected total length of 58 mm and haft length of 33mm. Haft to length ratio is about 0.57. The larger Linton site specimen has a projected length of 120 mm, with the haft making up about 74 mm and a ratio of 0.62. Stanford (1978:Figure 10.8) illustrates a size range at the Jones-Miller site in Colorado which would accommodate both of the Plainville Valley specimens.

At the Casper site in Wyoming, there is a large range of variation in a sample of 60 Hell Gap points. Length is mainly a function of degree of reworking. However, point width, ranging from 21 to 39 mm, shows significant clustering at 28 to 36 mm. Of eight unreworked points, hafting element to overall length ratios are 0.39 to 0.52. Thickness varies from 6.0 to 9.0 mm with an average of 7.36 mm. Cross-sections are primarily lenticular and basal constriction dominant. Heavy impact fractures are present on 26 distal ends (Frison 1974).

The Plainville Valley Hell Gap points are significantly larger than those from the Casper site, although in all other respects they appear consistent. Stewart (1981) records three Hell Gap points from the Zander site in south-central Ontario, two tips and a reworked whole specimen. A fourth site, McDonald Ridge in southwestern Ontario, has also produced a Hell Gap mid-section similar to those from Plainville Valley. An average of actual and projected measurements for these four Ontario Hell Gap points is length 83 mm, width 33 mm, stem length 49 mm, basal width 17 mm, and thickness 7.7 mm. The Ontario points, at the upper range of thickness, width and haft element length of the Hell Gap type, have an average haft to length ratio of 60%, which may identify a regional variant for the type.

Frison (1974) records radiocarbon dates of 9,830±350 and 10,060±170 B.P. at the Casper site. Agogino and Gallway (1965) record a date of 9,650±250 B.P. for Hell Gap at the Sister's Hill site, Nebraska. An age range of 10,000 to 9,500 B.P. is suggested for Hell Gap based on a series of dates in the northern Plains (Irwin Williams *et al.* 1973). A maximum age is provided by a date of 10,300 B.P. on charcoal beneath a Hell Gap occupation at the type site (Irwin Williams *et al.* 1973:48).

Madina

COLD SPRINGS, MCINTYRE SITE: *Figures 2.4 and 2.21.* The Madina Late Palaeo-Indian lanceolate point type was first recognized in 1988 and is best known from the lowlands of south-central Ontario (Dibb and Ellis 1988). There are two known examples from the Rice Lake area – one from Plainville Valley and one from the McIntyre site on the north shore of Rice Lake – only seven km from Plainville Valley across the lake. Dibb (personal communication, 1997) has also recorded a Madina point from the Otonabee River north of Rice Lake. Typical measurements for Madina points in Ontario are: 36 to 88 mm length (with a mean of 52 mm), 18 to 28 mm width (mean 22.5 mm), 3 to 11 mm thickness (mean 6.6 mm), stem length of 16 to 35 mm (mean 23.7), and blade length of 14 to 53 mm (mean 29.2 mm). Resharpening of these points results in a wide range of metric variation.

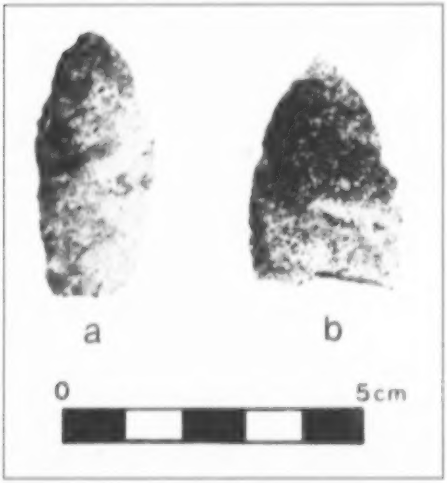


Figure 2.21 Two Madina Points on a) Onondaga Chert from the McIntyre Site (BbGm-2) and on b) Balsam Lake Chert from the Cold Springs Site (BaGn-79).

A complete resharpened Madina point on Onondaga chert was found in William McIntyre's collection from the McIntyre site on the north shore of Rice Lake (Figure 2.6b). It is a diminutive, contracting stemmed example with gently excurvate lateral edges, collateral to parallel flaking, greatest width just above mid-point, straight base, and lightly ground basal edges. This point is 47.0 mm long, 20.8 mm wide, 5.6 mm thick, weighs 5.36 grams, and has a basal width of 11.2 mm. Stem length is about 25.0 mm, with a stem to total length ratio of 0.53 – comparable to Hell Gap. Cross-section is flat and biconvex.

A larger example of a Madina point on Balsam Lake chert, a preferred Late Palaeo-Indian material in south-central Ontario, was found at the Cold Springs site on the high Oak Ridges Moraine overlooking Plainville Valley (Figure 2.21). Although the base of this point is missing, it appears to be unresharpened and shows characteristic lateral edge expansion, significant contraction of the stem below mid-point, collateral to parallel flaking, flat to biconvex cross-section, and typical Madina measurements. Length of the tip section is 40.0 mm, width 26.8 mm, thickness 6.4 mm, and weight 7.63 grams. Blade length above mid-point widening, which defines the end of the stem or haft, is 27.7 mm – within the Madina type mean.

Madina points are most commonly found in the Simcoe Lowlands of south-central Ontario although isolated examples do occur in southwestern Ontario. At the Heaman site near Lake Huron, recovery of a Madina point below the Lake Algonquin strand suggests an age after 10,300 B.P. (Ellis and Deller 1986).

Unknown Lanceolates

ALDERTON SITE: *Figures 2.4 and 2.22.* A lanceolate point tip on Balsam Lake chert was found on a slight rise overlooking the north bank of Plainville Stream at the Alderton site in Plainville Valley. This partial specimen is 27.5 mm long, 18.4 mm wide, 4.9 mm thick, and weighs 2.64 grams. Cross-section is flat to biconvex and the point is parallel-sided with greatest width at the snapped mid-section. There is also some distal reworking and bevelling of the tip. This may also be a Madina point as it contracts just below mid-point above the break, has a characteristically flat cross-section, and is thin and within the general metric range of Madina. Flaking is collateral to parallel and the use of Balsam Lake chert may also tie this specimen to the Late Palaeo-Indian period in Ontario.

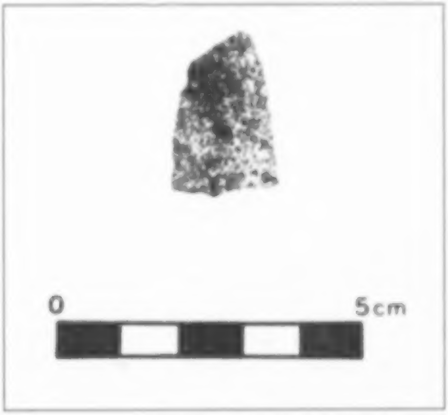


Figure 2.22 Lanceolate Point Tip on Balsam Lake Chert from the Anderton Site (BaGn-91).

The Keiffer Collection, Coboconk, Ontario (Table 2.1; Figures 2.4 and 2.10). Nearly thirty-five years ago, during a preliminary survey of sites and collections in the Trent Canal system and its watershed, Fred Richardson photographed a small collection of points that included definite Late Palaeo-Indian types. The Kieffer Collection, consisting of "flint arrowheads, lance points, and fragments found in the Coboconk area" includes at least one Agate Basin point and a small Eden-Scottsbluff point.

Coboconk is located about 60 km northwest of Rice Lake along the northeast arm of Balsam Lake. A single photograph of the collection is preserved at Trent University. As well as the two recognizable Late Palaeo-Indian points, there is one drill, a Middle Archaic corner-notched point, and an unknown stemmed point shown in the photograph (see Figure 2.10).

The Coboconk specimens are the northernmost known examples of the Agate Basin and Eden-Scottsbluff types in southern Ontario. Although no measurements are available, the Agate Basin point (upper right of Figure 2.10) is clearly long and thick and expands gradually from its narrow base until mid-point where the blade expands rapidly. It is similar in proportion to a Hell Gap point with a long and narrow haft and straight base. There are two slight lateral edge notches just below mid-point – higher on one side than on the other – which likely relate to hafting. Haft element to total length ratio is just above 0.50.

The Eden-Scottsbluff-like point (center of Figure 2.10) is much smaller, shorter, and narrower than the Agate Basin example. It shows parallel flaking and a slightly concave base. Lateral edges are parallel until just past mid-point and then converge rapidly towards the tip so that this example has the appearance of an elongated parallel-sided point.

I am indebted to the late Richard Johnston of Trent University for permission to photograph the Keiffer Collection photograph. My attempts to locate the collection site in the early 1980s were not successful, as Mr. Kieffer had, by that time, died.

The Plainville Valley Sites

Intensive survey of Plainville Valley south of Rice Lake in south-central Ontario produced evidence of five distinct Late Palaeo-Indian point types from eight sites scattered through the valley and on the nearby Oak Ridges Moraine. Although only short-term hunting sites are indicated, it appears highly likely, with 50% of the total valley land surface area surveyed, that additional sites are present. From other investigations in the southern Rice Lake area (see Jackson 1988, 1994) it is suggested that a seasonal hunting area for small dispersed groups may be represented. In the Early Palaeo-Indian period, evidence exists for small, logistically focused task groups of perhaps a dozen individuals at key extraction and residential sites.

Figure 2.23 presents a histogram of diagnostic projectile points recovered by multi-year survey in the southern Rice Lake region, including Plainville Valley. This indicator of prehistoric activity shows an increase in the Late Palaeo-Indian and Early Archaic periods over the preceding Early Palaeo-Indian period – suggesting either more frequent use or greater population. The Middle and Late Archaic (combined in the histogram) show another pronounced increase. The Early Woodland is the first period with widespread presence of a single point type. Meadowood points found as isolated hunting/butchering losses may reflect increased activity or population coincident with the introduction of cultigens after about 600 B.P. Overall, activity levels are low in Plainville Valley throughout prehistory and the nature of sites located supports consistent short-term hunting activity.

The Plainville Valley data represents the results of a highly focused survey of a single interior physiographic feature with no unusual occupational advantages. Survey results tend to disprove the notion of an ephemeral Late Palaeo-Indian occupation in southern Ontario – suggesting instead a widespread pattern of hunting site use. Available evidence suggests a similar occupational intensity to that for the Early Palaeo-Indian period, rather than a marked drop in population at the end of the Pleistocene.

Significantly, we do not have survey data for the large flooded land surface areas exposed during low-level post-glacial lake stands in the Ontario basin – only about 15 km south of Plainville Valley – or, for the historically flooded Rice Lake shoreline only a few km to the

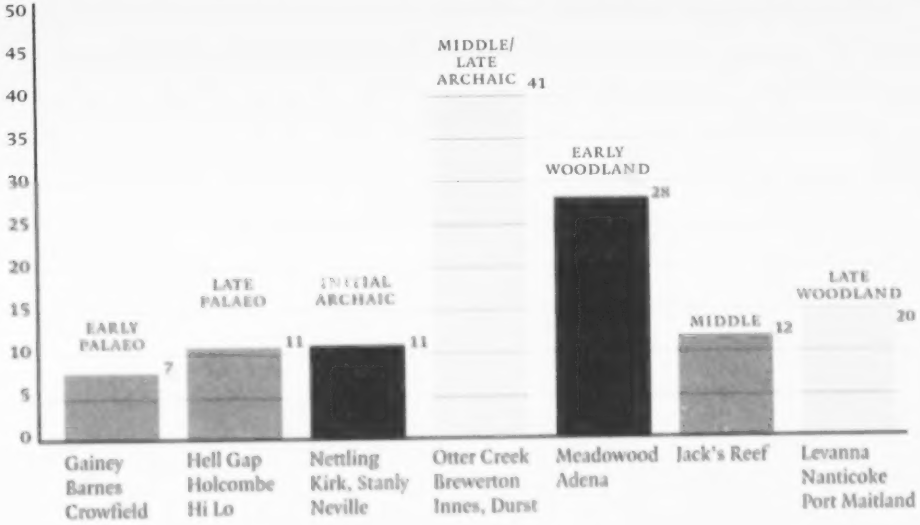


Figure 2.23 Histogram of Diagnostic Projectile Point Frequency, Southern Rice Lake Region.

north. It appears likely that the regional Late Palaeo-Indian record is severely truncated by flooding of sites and also by the relative scarcity of area-intensive archaeological surveys. The Plainville Valley data suggests that comprehensive survey will actually produce similar results on Late Palaeo-Indian occupation elsewhere in southern Ontario. What we are seeing, I strongly believe, is only a small part of the total record – the evidence of interior, non-lacustrine settlement.

Summary and Conclusions

This paper reviews evidence for Late Palaeo-Indian occupation in southern Ontario and suggests that seven different types of period diagnostic projectile points are representative of a substantial presence which has been masked by truncation of the archaeological record by extensive flooding of Great Lakes margins. Updated distributional maps, after Ellis and Deller (1990), document widespread patterns of southern Ontario occupation, possible regional emphases, and areas of more intense use which actually correspond with survey activity.

Geological evidence is presented which suggests a significant truncation of the Late Palaeo-Indian record by flooding of thousands of square km of land surface around the Great Lakes basins circa 10,000 B.P. Differential rates of flooding have affected each major basin (Huron, Erie, and Ontario) and help explain an apparent discrepancy between the rich Late Palaeo-Indian record along the isostatically raised beaches of the north shore of Lakes Superior and Huron and the impoverished record of southern Ontario.

Comprehensive survey of a small interior valley (Plainville) south of Rice Lake, south-central Ontario in 1985 and 1986 strongly suggests that we are seeing a pattern of seasonal

Table 2.2 A Late Palaeo-Indian Point Series for Southern Ontario

Suggested Age	Southern Group	Northern Group
10,300–10,000 B.P.	Holcombe	Agate Basin
10,000–9,800 B.P.	Plainville +	Hell Gap/Madina
10,000–9,500 B.P.	Hi-Lo (3 forms) *	Eden-Scottsbluff

+ Jackson (1998) suggests a new type, Plainville, is intermediate between Holcombe and Hi-Lo, with greatest morphological affinity to Holcombe and continuity with earliest Hi-Lo.

* Ellis (this volume) suggests three Hi-Lo forms—earliest Hi-Ho dating between Holcombe and Classic Hi-Lo, Classic Hi-Lo dating after Holcombe, and Side-Notched Hi-Lo dating close to Early Archaic side-notched forms.

use of interior landscapes by small hunting groups (see Jackson 1994) ranging inland from now-flooded proglacial lake strands. Survey of Plainville Valley produced evidence of four known Late Palaeo-Indian point types, Holcombe, Hi-Lo, Hell Gap, and Madina, and also one new type, Plainville. Evidence from the rest of southern Ontario suggests that we may be seeing two basic and overlapping Late Palaeo-Indian cultural expressions – namely, northern groups using contracting stemmed lanceolates (Agate Basin, Hell Gap, and Madina) and southern groups using fluted point derived forms such as Holcombe, Plainville, and Hi-Lo. Of the two missing known types, Agate Basin and Eden-Scottsbluff, nearest records to Plainville Valley are from Coboconk, Ontario only 60 km northwest of Rice Lake. Continued survey of Plainville Valley might reveal the presence of these two types as well.

Geochronological and typological evidence suggests a Late Palaeo-Indian time series in southern Ontario. Agate Basin and Madina points that were found below the Lake Algonquin strand in southwestern Ontario must post-date the end of that lake circa 10,300 B.P. Hell Gap points are well dated in the Plains near 10,000 B.P. Palynological associations (see Dibb, this volume) suggest that Madina in south-central Ontario may date circa 10,200 to 9,800 B.P. Although Holcombe and Hi-Lo points have no associated dates, even at the type sites in Michigan, morphological attributes indicate that Holcombe is an immediate fluted point successor after about 10,300 B.P. (see Ellis, this volume) while side-notched Hi-Lo points are an Early Archaic precursor circa 9,500 B.P.

Table 2.2 presents a suggested time series for southern Ontario Late Palaeo-Indian points based on available chronological clues and suggested morphological relationships. The newly described Plainville type (Jackson 1998) and recently recognized Madina type (Dibb and Ellis 1988) both appear to be regional types with a focus in south-central Ontario. It is strongly suggested that other new types will be recognized, particularly in view of the variety of forms which are already seen to fall between Holcombe and latest Hi-Lo (see Ellis, this volume).

Clearly, there is a wealth of information on Late Palaeo-Indian occupations in southern Ontario that has either not been collected or is flooded and no longer accessible. Evidence of waterworn artifacts from the Heaman site in southwestern Ontario demonstrates that Great Lakes flooding in fact submerged various Late Palaeo-Indian occupations. The most important emphasis of this paper is on the need for more concerted survey efforts, especially in areas of near-shore submergence, to establish the real nature of southern Ontario's Late Palaeo-Indian record.

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3.

Hi-Lo: An Early Lithic Complex in the Great Lakes Region

Christopher Ellis

Abstract

This paper summarizes current knowledge of Hi-Lo lithic assemblages and sites, as they are known from southern Ontario. Few sites have been excavated and assemblages are small and largely from disturbed contexts. The best known aspect is the distinctive, concave-based, heavily laterally ground, stone points. These range from simple lanceolates, to slightly stemmed, to weakly side-notched – a sequence which may represent a temporal trend within Hi-Lo. Available data, with notably an emphasis on recycling points into other tool forms and resharpening them by alternate edge bevelling, suggest Hi-Lo is most similar to Dalton materials found to the south, which date to ca. 10,500 to 10,000 B.P. Stylistically, technologically, and developmentally, Hi-Lo seems to provide a direct link and evidence of continuity between the earlier fluted point/Holcombe assemblages and subsequent assemblages characterized by markedly notched projectile points which most regard as Early Archaic. However, overall, the lithic procurement practices, core reduction strategies, and tool kits of Hi-Lo seem much more like those of earlier developments than immediately subsequent Archaic industries. Some have attempted to explain the appearance of notched points as indicating the introduction of the spearthrower as opposed to the simple hand-launched spear, but it is argued here that there are other explanations which can better account for this transition in behavioural terms.

Résumé

Cet article présente une synthèse de nos connaissances actuelles en matière d'assemblages lithiques et sites Hi-Lo du sud de l'Ontario. Peu de sites ont été fouillés jusqu'ici, les assemblages sont limités et proviennent, en grande partie, de contextes perturbés. Les pointes à base concave et à fort émoussage latéral, très distinctives, en sont l'élément le mieux connu. Elles comprennent de simples lancéolées, des pointes légèrement pédonculées, et des

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pointes à encoches latérales peu prononcées – une séquence qui peut représenter une tendance temporelle à l'intérieur du Hi-Lo. Les données dont nous disposons, notamment la prépondérance d'outils recyclés sous d'autres formes d'outils et d'outils réaffûtés par biseautage alterné, semblent indiquer que Hi-Lo ressemble le plus aux matières Dalton trouvées plus au sud et qui datent d'entre 10 500 et 10 000 A.A. environ. Des points de vue stylistique, technologique et culturel, Hi-Lo semble fournir un lien direct ainsi que des témoignages de continuité entre les assemblages de pointes à cannelure/Holcombe antérieurs d'un côté, et de l'autre les assemblages postérieurs dont les pointes de projectile à encoches profondes sont caractéristiques et que la plupart des autorités considèrent comme Archaïques inférieures Dans l'ensemble, cependant, les pratiques d'acquisition de pierres, les techniques de réduction du nucleus, et la « trousse à outils » du Hi-Lo ressemblent beaucoup plus aux développements antérieures qu'aux industries Archaïques immédiatement postérieures. Certains ont cherché à expliquer l'apparition de pointes à encoches comme une indication de l'adoption du propulseur de javelot, à la place du javelot simple lancé à la main, mais nous faisons valoir dans cette communication d'autres explications qui rendraient mieux compte de cette transition.

Introduction

This paper provides an overview of current knowledge of Hi-Lo, an early lithic complex in the southern Great Lakes area. The specific goals are to: 1) provide an up-to-date summary of our knowledge of Hi-Lo stone tool kits, lithic procurement practices and settlement; 2) discuss the evidence we have for the age of Hi-Lo assemblages; and 3) to address the question of whether or not Hi-Lo is best conceived of as a Late Palaeo-Indian industry (as suggested by Fitting (1963a) and others) or, as being an Archaic industry (as suggested by those such as Wright (1995). In the process of addressing the last question, I draw heavily on my first-hand knowledge of definitive Ontario materials. Examples of Palaeo-Indian materials were obtained from fluted point sites (e.g. Deller and Ellis 1984, 1992a, 1992b; Ellis 1984, 1993; Ellis and Deller 1997) and examples of Early Archaic materials were found at sites such as Nettling and Culloden Acres Area B (Ellis and Deller 1991; Ellis *et al.* 1991).

Background

Hi-Lo is so named after the type site on the Hi-Lo Gun Club in southern Michigan (Figure 3.1) reported in the early 1960s by James Fitting (1963a, 1963b). Since that time the most distinctive artifact of this complex, the Hi-Lo point (Figure 3.2) has been reported across the southern Great Lakes area from Minnesota, Wisconsin and Illinois in the west/southwest (e.g. Evans and Womac 1998; Overstreet 1993; Shay 1971) to southern Ontario, northern Ohio and western New York in the east (e.g. Ellis and Deller 1982; Payne 1982; Smith *et al.* 1998:8–10; Stothers and Abel 1992). Not only is this material widespread but it is also quite common and in fact, is the most common "Late Palaeo-Indian" (e.g. lanceolate unfluted point) material by far, found in many areas such as southern Ontario (see, for example, Deller 1989). Despite the relative abundance of reported sites and finds, many sites are known only through sur-

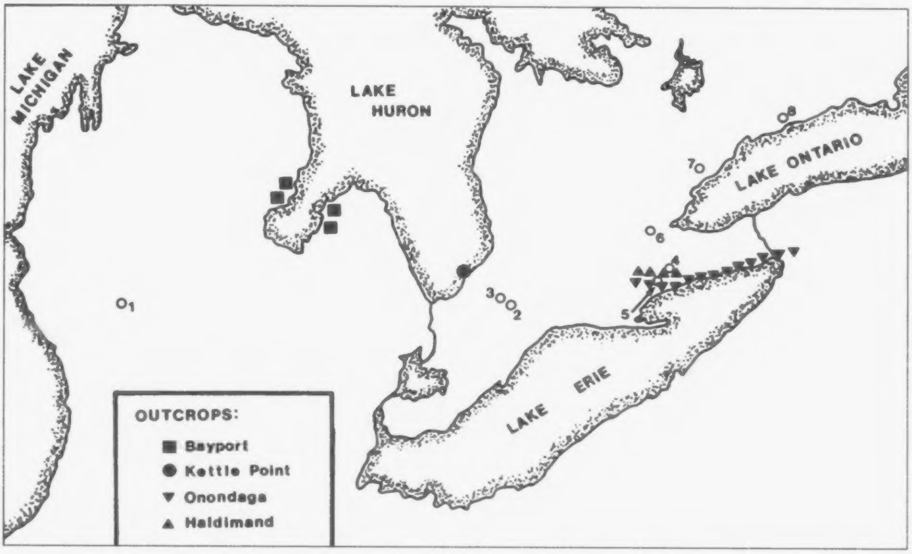


Figure 3.1 Location of Some Sites and Chert Outcrops Mentioned in the Text. Sites: 1. Hi-Lo; 2. Welke-Tonkonoh, Stewart, Stephenson, Caradoc; 3. Strathroy; 4. Allan; 5. Stelco 1; 6. Witz and Koeppe II; 7. Ageing Maple; 8. ENL Hi-Lo.

face collection (e.g. Bursey 1998; Timmermans 1999). Only eight and perhaps nine Ontario sites have seen any degree of excavation. These include (Figure 3.1) the Stewart (AfHj-6) and Strathroy (AfHj-7) sites briefly tested under the direction of William B. Roosa and Brian Deller in the early 1970's (Deller 1988:284–288; Ellis and Deller 1982); the Welke-Tonkonoh (AfHj-5) site investigated in the early 1970's by Roosa and again in 1980 by this author (Ellis and Deller 1982; Muller 1988, 1989; Moulton 1990); the Allan (AfGx-50) site test excavated by Bud Parker (1986a, 1986b); the Stelco 1 site investigated by Peter Timmins (1995); the Caradoc (AfHj-104) site, excavated in the summer of 1997 (Deller and Ellis 2001); the Ageing Maple site (AkGv-91) investigated by Murray (1997); and the Witz site (AhHa-80) Locus C test excavated in advance of Highway 403 construction under the direction of Woodley (1997). Although no diagnostic artifacts (e.g. Hi-Lo points) were recovered from the Koeppe II site, also excavated in advance of the Highway 403 construction (Figure 3.1), it appears to be a Hi-Lo component (Woodley 1997).

Lithic Procurement

All artifacts, which are attributable to Hi-Lo, are made on fine-grained materials such as cherts. If one relies solely on data related to the material used for points in southern Ontario, then Hi-Lo knappers relied relatively heavily on Haldimand and Kettle Point cherts and less so on other cherts such as Onondaga, Selkirk and Bayport (Deller 1989). However, Deller (1989) cautions that the frequency of cherts used for points on early Ontario sites does not necessarily mirror overall chert use. In fact, if one relies on total tool assemblages from sites

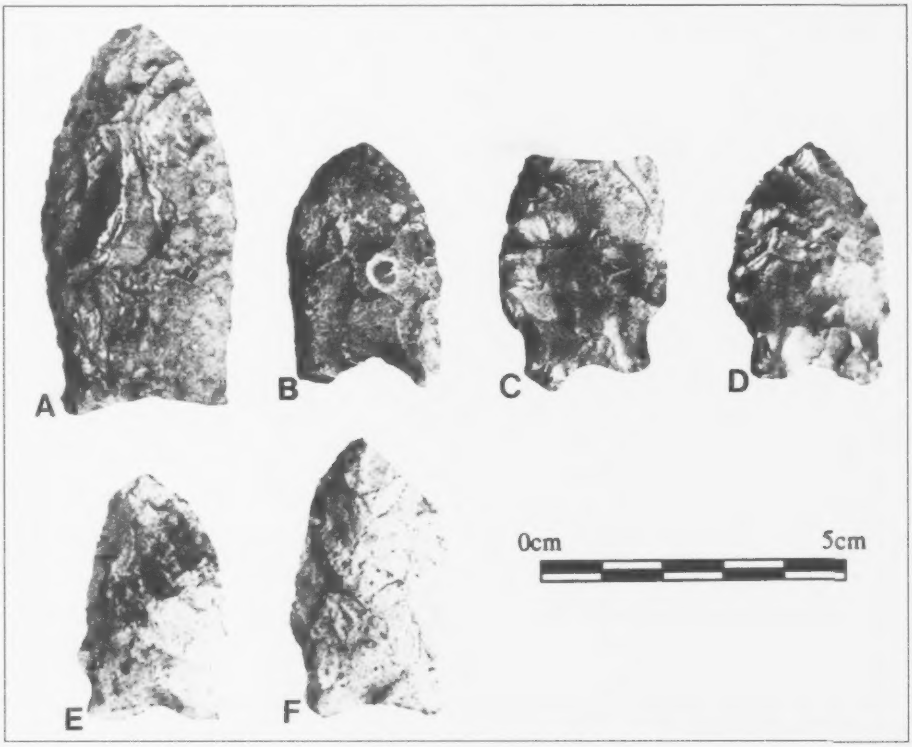


Figure 3.2 Hi-Lo Point Varieties. a–b: Holcombe-Like/Hi-Ho; c–d: "Classic" Stemmed Hi-Lo; e–f: Side-Notched Hi-Lo. a: Caradoc site, Onondaga(?) chert; b: Stewart Site, unknown chert; c–d: Welke-Tonkonoh site, Area A, Kettle Point chert; e: Stephenson site, Haldimand chert; f: Welke-Tonkonoh site, Area C, Haldimand chert.

rather than simply projectile points, only Haldimand chert was commonly used (although at least one site assemblage made almost totally on Bayport chert is known; see below). Therefore, not surprisingly, a number of Hi-Lo sites have been found in the vicinity of the Haldimand chert outcrops (e.g. Bursey 1998; Parker 1986a; Timmins 1995). However, the overall emphasis on Haldimand might be a product of geographical biases in the small number of actual sites investigated to date and at least the Ageing Maple site yielded solely Onondaga debitage (Murray 1997). In any case, despite the small number of sites available, three characteristics of lithic procurement seem apparent.

First, examination of original unflaked surfaces of the raw material retained on tools and flakes indicate that primary outcrops were the ones primarily used to obtain raw materials with relatively minor use of secondary deposits. This preference for bedrock sources is one found on earlier fluted point sites as well (e.g. Ellis 1989) and contrasts with that seen on definitive Early Archaic sites where there is extensive use of secondary deposits (Ellis and Deller 1991; Ellis *et al.* 1991).

Second, Hi-Lo sites can be found at a considerable distance (120+ km) from a particular chert outcrop and yet, over 80% of the assemblage can be on that chert. A good example is Area C at the Welke-Tonkonoh site, which is one of the few locations where there is little or no evidence of later occupations and where, consequently, the assemblage associated with the Hi-Lo occupation can be more easily determined. At that site area, of the 20 tools recovered, over 80% are on Haldimand chert from outcrops about 175 km away (Parker 1986a, 1986b). Similarly, at the ENL Hi-Lo site on the north shore of Lake Ontario investigated by Arthur Roberts (1985:211-212) over 80% of the assemblage of 59 pieces recovered in surface collection are on a homogeneous, relatively high quality, white chert. According to Roberts (1985:212) this material is "Lockport" (Ancaster) chert from the west end of Lake Ontario some 120 km away. However, based on my direct examination of that assemblage, I believe that identification is incorrect. Roberts (1985) was unaware of the existence of Haldimand chert and had no such material for his comparative analyses. If he had comparative Haldimand samples I am sure he would have identified the artifacts as being on that chert and from sources at least 200 km distant (Figure 3.1). Regardless, the ENL assemblage is predominantly on a single chert type from at least 120 km away. A final example is the recently excavated Caradoc site. Although a tool "cache" of some kind, the assemblage is definitely on Bayport chert from Michigan which must also have been imported from about 200 km away (Deller and Ellis 2001). Overall, these examples suggest little distance-decay in the frequency of a particular chert with increasing distance to source until presumably, some point beyond 200 km where there is an abrupt drop-off in the frequency of a chert. This pattern is one which is widespread on fluted point sites in the Great Lakes area (Ellis 1989) and suggests particular Hi-Lo groups may have actually exploited directly only one source on an annual round – a pattern which contrasts with Archaic assemblages dating from the earliest to latest dating (see Ellis and Spence 1997; Ellis *et al.* 1991)

Third, known outcrops of the Haldimand chert so widely used by Hi-Lo peoples are located in the same area as outcrops of the major chert used throughout southern Ontario prehistory, namely Onondaga. Yet, despite the proximity of Onondaga outcrops, and the fact that the material is of a higher quality for flintknapping than Haldimand chert, Onondaga chert was rarely used on sites in the outcrop areas. For example, at the Stelco 1 site (Timmins 1995; see Figure 1), there are actually outcrops of Onondaga chert closer to the site than the nearest outcrops of Haldimand (13 versus 21 km away). Yet, less than 1% of the assemblage is on Onondaga. In my opinion, the apparent avoidance of Onondaga, and the use of Haldimand at long distances from its source at sites such as Welke-Tonkonoh, cannot be explained by ignorance of Onondaga chert sources – Onondaga was heavily used in earlier fluted point times. Neither can a desire for higher quality material explain the preference for Haldimand as it is of equal or lower quality for flintknapping compared to Onondaga. Rather, and as I have argued for chert preferences on fluted point sites (Ellis 1984, 1989; see also Parker 1986a; Timmins 1995), these preferences seem to have been for primarily non-utilitarian reasons.

Lithic Tool Kits

Points

The most distinctive aspect of Hi-Lo is of course, the projectile points. Nonetheless, despite this fact, just what constitutes a Hi-Lo point has never been made very clear or precise. It is, to quote Mason (1981:114), a "loosely defined type." It is for this reason, among others, that I use what I consider a general "grab-bag" term, "complex," to refer to materials lumped under the Hi-Lo banner rather than more specific terms such as "phase." Prior to Fitting's (1963a) work, Hi-Lo points were often lumped into larger categories, such as Aqua-Plano (Quimby 1960) and Unfluted-Fluted (Prufer and Baby 1963) – categories which also often subsumed a diversity of other point varieties such as Agate Basin-like and Scottsbluff-like forms. In his original report on the Hi-Lo site, Fitting (1963a) also recognized a wide range of variation within what he called Hi-Lo. He attempted to deal with this variation by determining three sub-types based largely on variation in blade length. Later, he recognized that this variation was largely due to tip resharpening which could alter blade length, and that his subtypes therefore, were of little utility as time-space markers (Fitting 1970:42).

Ellis and Deller (1982) also emphasized that there was considerable variation within Hi-Lo points due to resharpening. This resharpening included not only tip resharpening, which could affect fore-section length, but also lateral resharpening, often by alternate edge-bevelling, of the fore-section edges which resulted in reductions in fore-section width and in extreme cases, could produce fore-sections with concave lateral margins. At the ENL site (Roberts 1985: Figure AIV-2) it was even possible to replace some of the beveling resharpening flakes recovered onto the side edges of a Hi-Lo point recovered from the site. This lateral resharpening is something not seen on presumably earlier forms such as fluted points or Holcombe and suggests that unlike those other point forms, Hi-Lo's were designed to serve extensively as knives in addition to projectile tips. Also, and again in contrast to fluted and Holcombe points, Ellis and Deller (1982:9) presented evidence indicating Hi-Lo points could be recycled into a number of other tool types. These included recycling into end scrapers, simple side scrapers, simple notches, well-flaked spokeshaves, micro-piercers or gravers, and "drills" or perforators (Figure 3.3, 3.7b). In addition, some points were only beveled on one fore-section edge to form a specialized form of side scraper (Figure 3.3a–b). Also, a number of snapped bases have evidence suggesting that the thick snap juncture with one or both faces of the tool was used in heavy scraping tasks (Figure 3.3g–h).

It is true that all Hi-Lo points are relatively thick with moderately deep concave bases, short basal thinning, heavy grinding of the lateral basal edges/basal concavity, and pronounced ears, and that they lack the refined patterned parallel-collateral facial flaking seen on most other Palaeo-Indian point forms. Nonetheless, there is still considerable variation within what is usually called Hi-Lo, which seems to have little to do with resharpening and recycling. This variation is seen mainly in haft element morphology, could easily be of temporal significance (see below), and leads me to propose that we can divide what has been called Hi-Lo in Ontario in the past into three distinct sub-types. In the future, it might be preferable to elevate these sub-types to types and make them diagnostic of three phases (e.g. the smallest temporal/spatial unit within which one cannot demonstrate any significant

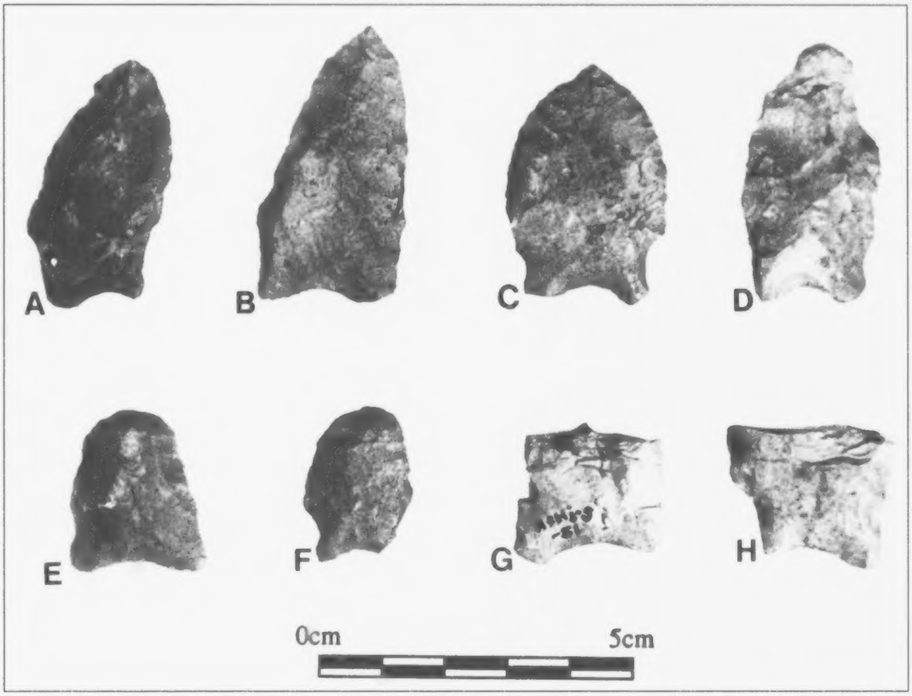


Figure 3.3 Recycled Hi-Lo Points. a: specialized side scraper with bevel on left margin only, Kettle Point chert, Welke-Tonkonoh, Area A subsoil deposit; b: specialized side scraper with bevel on left margin and micro-piercer/graver at tip, unknown chert, Welke-Tonkonoh, Area D; c: micro-piercer/graver at tip, Kettle Point chert, Welke-Tonkonoh site, miscellaneous surface; d: fore-section notch, Haldimand chert, Welke-Tonkonoh, Area A; e: end scraper, Kettle Point chert, Stewart site; f: end scraper, Kettle Point chert, Welke-Tonkonoh site, Area A; g-h: snapped basal ends showing location of heavy wear/crushing at snap/face juncture, Haldimand chert, Welke-Tonkonoh site, Area A.

cultural changes; see Clarke 1968) as has been done elsewhere for fluted points (e.g. Ellis and Deller 1997).

All the Hi-Lo sub-types seem very similar to each other in terms of being resharpened in comparable manners and being recycled into the same range of forms. They differ mainly in hafting element configuration. One form, which I propose to continue to call Hi-Lo or "Classic" Hi-Lo (Figure 3.2c–d), has a slight stem, often with slightly concave stem side margins. The fore-section width expansion beyond the stem width can be largely removed over the use-life of the tool by extensive resharpening of the lateral fore-section edges. Often only "nubbins" of the stem-fore-section juncture remain. Most often, this reduction in fore-section width is accomplished by alternate edge beveling (see Ellis and Deller 1982:7–8). This sub-type is the most common form of Hi-Lo reported and has been recovered from sites such as Welke-Tonkonoh, Stewart and ENL Hi-Lo.

The second sub-type has definite, although shallow, side-notches instead of a simple stemmed haft element (Figure 3.2e–f), and has been reported from sites such as Stephenson, Stelco I and A[illegible]eing Maple. It is also reported from sites that have yielded the stemmed forms such as Stewart and Welke-Tonkonoh.

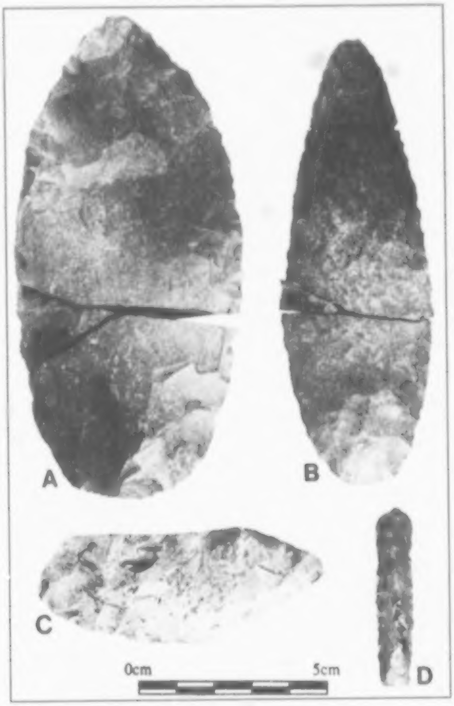
The final sub-type has often been lumped in within the general Hi-Lo rubric by this author (e.g. Ellis and Deller 1982: Figure 2d) as well as other investigators (e.g. Fitting 1963a: Plate 3a–b, 1970: Figure 2, lower row, two items at right). This sub-type lacks both the stem or side-notches of the other two types and it is apparent the lack of a stem or notches is not due to resharpening. In this respect they actually resemble Holcombe points (see Fitting *et al.* 1966) and in fact, have been called Holcombe-like (Ellis and Deller 1990: Figure 3.12c–d) elsewhere. However, they lack the refined flaking and are much thicker than the finely flaked and ultra-thin Holcombe forms. Moreover, points in this third sub-type also tend to have knobby and more pronounced ears than Holcombe points. Since they actually seem to combine characteristics of both Holcombe and classic Hi-Lo points, some years ago, in jest, Lawrence Jackson (personal communication) called them "Hi-Ho" points and others have begun to use that term for this Hi-Lo variety (Timmermans 1999). Hi-Ho points are reported from sites such as Caradoc, Strathroy and again, Welke-Tonkonoh. As with the previous sub-types, they can have quite extensive lateral fore-section resharpening and this resharpening can be done by alternate beveling.

It is very possible that the three sub-types of points recognized herein represent a time series. Based on principles of typological/stylistic dating, one can argue that Hi-Ho points blend characteristics of both Holcombe points and Hi-Lo because they represent an intermediate period of time (Ellis and Deller 1990:57). Given the similarities of these forms to Holcombe and even fluted point forms such as Crowfield (Deller and Ellis 1984), the Hi-Ho points would be the earliest in the sequence considered here. Similarly, and as suggested elsewhere (Ellis *et al.* 1990:71), the side-notched Hi-Lo forms could be seen as the latest dating, following the classic stemmed forms. Certainly, side-notched points seem to represent the earliest notched point forms throughout much of eastern North America (Driskell 1996; Ellis *et al.* 1998; Tuck 1974) and in fact, have been dated to as early as 9,600 B.P. by 14C in the southern Great Lakes area, specifically the lower peninsula of Michigan (Shoshani *et al.* 1989, 1990).

Other Tools

It has been difficult to delineate the rest of the Hi-Lo stone tool kit. Our first in-depth insights into the nature of this tool kit resulted from the author's work at the Welke-Tonkonoh site in 1980. This work included the discovery and partial excavation of an area that, except for a single Late Woodland body sherd, has yielded a homogeneous lithic assemblage largely on Haldimand chert and including solely Hi-Lo diagnostics (Area C). In addition, there was the discovery in another small area (Area A-West), of intact subsoil Hi-Lo materials below the ploughzone along an old fence-line (Ellis and Deller 1982; Moulton 1990; Muller 1989). Since that time the work at other sites has slowly provided accumulated knowledge on these tool kits, and the work in progress on the Caradoc site collection will certainly assist in rounding out our knowledge in this area.

Figure 3.4 Miscellaneous Hi-Lo Bifaces. a: large biface core/preform(?), Bayport chert, Caradoc site; b: lanceolate "knife", Bayport chert, Caradoc site; c: backed biface, Haldimand chert, Stewart site; d: stemmed twist drill, Kettle Point chert, Welke-Tonkonoh Area A.



In addition to points, other Hi-Lo bifacial artifacts include preforms for points, a few of which have edge polish, suggesting they were also used as knives. There have been other artifacts such as large bifaces, which may be knives, very early stage preforms for points, cores for producing tool blanks or a combination of these purposes (Figure 3.4a). Biface knives of several forms, including those with a semi-lunar outline and a flat thick "back" along the straight margin to hold or haft the tool (Figure 3.4c), plus others with a roughly tear-drop-shaped outline (Figure 3.4b; Woodley 1997: Figure 13a) have also been located. Additionally, stemmed blunt-ended "twist" drills with the characteristic "S-Shaped" bit (Figure 3.4d) have been found. Virtually all of these tool/artifact forms are reported on earlier fluted point sites (see, for example, Deller and Ellis 1992a, 1992b; Ellis and Deller 1982, 1988). However, some items such as the twist drills have only been reported from fluted point sites like Bull Brook, Massachusetts (Byers 1954: Figure 92), which lie outside the Great Lakes area. The only possible exception is the tear-drop shaped knife from the Koeppe II site (Woodley 1997: Figure 13a), which seems to more closely resemble the slightly asymmetrical large knives ground along one margin from Early Archaic sites such as Nettling (Ellis *et al.* 1991: Figure 5a–c). On the other hand, as noted above, Koeppe II did not yield any diagnostic Hi-Lo points.

The Hi-Lo unifacial tool kit is also one which largely duplicates that seen on earlier fluted point sites (compare with Deller and Ellis 1992a, 1992b). These forms include trianguloid end scrapers, which sometimes have lateral, apparent hafting notches near the bit end such that they appear to be spurred (Figure 3.5g); simple well-made gravers; hafted tools variously referred to in the literature as beaked scrapers or nosed/narrow end scrapers (Figure 3.6b); simple side scrapers with edge forms ranging from concave to convex (Figure 3.5a–d); more complex side scrapers including concave forms which also exhibit spurs (Figure 3.6g); and multi-purpose tools (Figure 3.5e), exhibiting various combinations of borers, notches and denticulated edges. With the possible exception of gravers, simple beaks and concave side scrapers, virtually all these tool forms are not seen on Early Archaic sites such as Nettling (Ellis *et al.* 1991).

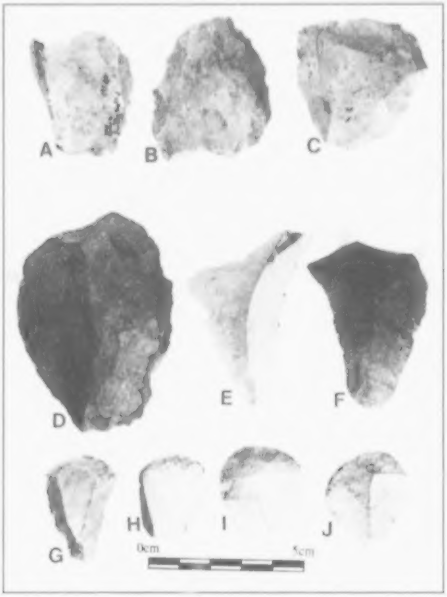


Figure 3.5 Hi-Lo Unifaces. a: single convex side scraper, Haldimand chert, Stewart Site; b-c: double convex side scrapers, Haldimand chert, Welke-Tonkonoh Area C; d: double convex side scraper, Bayport chert, Caradoc site; e: combination notch/borer/denticulate on large biface thinning flake, Haldimand chert, Welke-Tonkonoh site Area C; f: retouched flake/denticulate on large biface thinning flake, Bayport chert, Caradoc site; g: spurred end scraper, Haldimand chert, Welke-Tonkonoh, Area C; h-i: end scrapers, Haldimand chert, Welke-Tonkonoh Area C; j: end scraper, Haldimand chert, unnamed site adjacent to the Crowfield site.

Although most of the Hi-Lo tool kit is similar to those seen on fluted point sites, there are some minor differences. Trianguloid end scrapers do occur, but most end scrapers on Hi-Lo sites are smaller and more fan-shaped than their Palaeo-Indian counterparts (e.g. Figure 3.5h-j). In this regard they seem more similar to those reported on subsequent Early Archaic corner-notched horizon sites in Ontario such as Culloden Acres and Nettling (Ellis and Deller 1991; Ellis *et al.* 1991). However, they lack the extensive fine flaking of the dorsal face seen on many of the Nettling end scrapers, as well as on end scrapers from sites yielding Plano points (e.g. Julig 1994: Figure 5.27a, b). Some of the side scrapers seen on Hi-Lo sites are also quite distinctive from earlier (and later) forms. In addition to a finer edge retouch, these side scrapers often include some grosser facial retouch which extends back considerably from the tool edge (e.g. Figures 3.5a–d), and often they exhibit some gross inverse retouch on the underside as well, which technically gives them a crude bifacial retouch on some tool edges.

Finally, it is worth noting that no large woodworking tools such as adzes and axes, including ground stone tool forms, have as yet been reported from Hi-Lo sites. However, such certainly do occur on definitive Early Archaic sites such as Nettling (Ellis *et al.* 1991).

Primary Tool Production

Tool production techniques in Hi-Lo are also very similar to those seen on earlier fluted point sites. In particular, there is good evidence the Hi-Lo groups relied on formal core forms and the production from these cores of flake blanks of standardized shapes. However, there is no evidence of the use of such reduction technology in the Early Archaic in Ontario or at least in association with the use of serrated corner-notched points (Ellis *et al.* 1991:26). An example from Hi-Lo sites of standardized core use, which is also seen on fluted point sites, is the production of large thin tool flake blanks produced from very large biface cores (e.g. Figure 3.5e, f, i). In fact, several large bifaces recovered from the Caradoc site (e.g. Figure 3.4a) are of a size that could produce such flake blanks. Also, several of the tool blanks recovered from Hi-

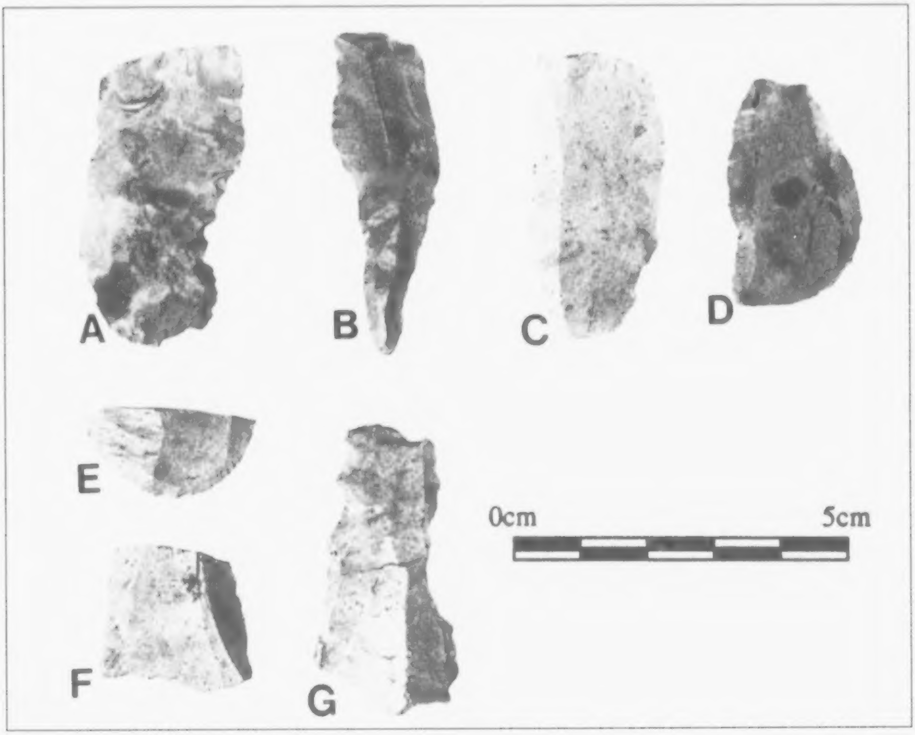


Figure 3.6 Small Hi-Lo Blades and Blade Segments. a: used flake on possible channel flake-like "initial blade," Onondaga chert, Welke-Tonkonoh Area C; b: beaked scraper on blade, Kettle Point chert, Welke-Tonkonoh Area A subsoil deposit; c: retouched blade, Haldimand chert, Welke-Tonkonoh, Area C; d: retouched blade, Onondaga chert, Welke-Tonkonoh, Area C; e: end scraper bit, Haldimand chert, Welke-Tonkonoh Area C; f: blade distal end, Haldimand chert, Welke-Tonkonoh Area C; g: combination graver/concave scraper on blade, Haldimand chert, Welke-Tonkonoh Area A.

Lo sites, especially the Caradoc site, are "blade-flakes" (cf. Callahan 1979:3) from large, unidirectionally reduced, roughly conical cores. The use of this kind of core is also reported from fluted point sites in the Northeast (e.g. Deller and Ellis 1992a:18; Payne 1987).

As another possible example of standardized tool blank production, but apparently using a form not reported from fluted point sites, there are suggestions of a blade industry in Hi-Lo. Certainly, several of the reported unifacial tools from Welke-Tonkonoh (Ellis and Deller 1982) and other sites like Southwinds (Timmermans 1999:8–9) are on small, definite or probable blades or blade segments in the formal/morphological sense of Bordes and Crabtree (1961; e.g. parallel-sided, twice as long as wide, longitudinal dorsal ridges/scars suggesting previous removals of the same form; see Figure 3.6). In the absence of actual cores it is always difficult to demonstrate that these are not just formal blades but also technological ones (e.g. those removed from a core specially designed to produce multiple examples of the same form). Nonetheless, the multiple longitudinal scars/ridges on complete blades in Hi-Lo are highly suggestive (see especially Figure 3.6g). In addition, one of the Hi-Lo items, from Area C at Welke-Tonkonoh, seems to represent the initial removal from a blade core. Although laterally flaked like a channel flake to set up a central guide ridge for an initial blade removal (Figure 3.6a), this item is reminiscent in *intent* of the "crested blades" or "lame à crete" of technologically defined blade industries.

In their analysis of the Holcombe site, Fitting *et al.* (1966:48–51) also reported a series of small "blades" which were made into the same range of tool forms as in Hi-Lo (e.g. end scrapers, concave scrapers, retouched flakes) and seem to formally mimic those reported here. It would appear this blank form originated or came into widespread use with Holcombe and was continued into subsequent Hi-Lo times. In fact, this evidence provides additional support for the idea of some "genetic" relationship between the two developments.

Sites

Almost all known Hi-Lo sites appear to be mainly residential campsites although there are some exceptions. One exception is the Allan site (Parker 1986a, 1986b) located next to outcrops of the Haldimand chert often used by Hi-Lo peoples. That site clearly is a lithic quarry site, possibly occupied by task groups organized mainly for the purpose of obtaining that stone material. Another exception is the Caradoc site, which includes solely a cache(s) of over 60, almost all purposefully broken, tools (Deller and Ellis 2001). Caradoc must represent a ceremonial/ritual location either as an offering(s) or cache of grave goods – the lack of any organic preservation prohibits definitive interpretations.

Among the other known sites, virtually all known locations are small (under ca. 200 m^2) and ephemeral with little in the way of tools and debris (usually less than 20 to 30 tools). In this respect, they seem to mirror earlier sites such as those associated with the fluted point occupations, which are also predominantly small and ephemeral. However, and as is the case with some earlier fluted point sites such as Parkhill (Deller and Ellis 1992a) and Fisher (Storck 1997), the odd larger site does exist such as Welke-Tonkonoh. Welke-Tonkonoh consists of at least five discrete concentrations of material distributed over an area of some eight hectares. Moreover, there are additional concentrations on adjacent farms such as the Stewart, Stephenson and Glen Oak sites, which, although recorded as separate sites, could just as easily be regarded as additional concentrations associated with Welke-Tonkonoh.

Most of the Hi-Lo concentrations at Welke-Tonkonoh and on the adjacent sites seem to be relatively small in size (e.g. under 200 m^2). However, at least one site area (Area A) at Welke-Tonkonoh covers in excess of 1500 m^2. Area A is not as large as some of the areas seen on earlier sites such as Parkhill and Fisher where individual concentrations are as large as 2000 m^2 in extent (Deller and Ellis 2000: Table 1.1; Storck 1997: Table 2.1). Also, and unlike sites such as Parkhill and Fisher, there is a much greater degree of variation in point forms recovered from this largest area at Welke-Tonkonoh, including all the sub-types denoted above. If that variation is indicative of time changes as suggested earlier, the largest area at Welke-Tonkonoh may have been produced by occupations over a much greater period of time than that seen on earlier fluted point sites – assuming comparable rates of change in point form. In terms of the number of concentrations/areas, and their usually small spatial extent and artifact yields, sites such as Welke-Tonkonoh also seem to resemble more closely unfluted lanceolate point sites in the Great Lakes area. Such sites would include those such as Holcombe (Fitting *et al.* 1966) with its thin concave-based lanceolate points and Deavitt (Dibb 1985) which is associated with plano forms resembling the Hell Gap points of the west. One difference though is that none of those sites seem to have areas as large as Area A at Welke-Tonkonoh.

It is worth stressing also that there are no reported Ontario Early Archaic sites (e.g. with notched points) which seem to resemble these larger sites such as Welke-Tonkonoh. Definitive Early Archaic sites, such as Nettling, Ontario with its corner-notched serrated points, seem to differ from every reported fluted or Hi-Lo site. This is due to the fact that despite a much smaller spatial extent, they have a very high density of material that is in excess of that seen at all the earlier sites including those of Hi-Lo (Ellis *et al.* 1991: 26–27).

Turning to the overall distribution of Hi-Lo points in Ontario, it is quite clear that Hi-Lo materials are found only within southern Ontario and more specifically, in areas closer to Lake Erie. They diminish in frequency as one moves north along the eastern edge of the Lake Huron shore and northeast in areas to the north of Lake Ontario. Although artifact findspots can occur farther north, all the major reported sites and the greatest density of sites are in the areas outlined. In direct contrast, Plano point forms such as those resembling the Agate Basin and Hell Gap points of the western plains are much more common in areas around the southern Huron basin and across the Simcoe lowlands and Rice Lake area north of Lake Ontario. Indeed, although actual Plano points do occur as isolated surface finds farther south in Ontario, actual sites of any substance are found almost exclusively in more northern areas (e.g. Dibb 1985; Ellis and Deller 1986; Jackson 1986, 1997; Stewart 1984). They are most certainly not all Archaic and not all later point styles misidentified as Plano, as implied by Wright [1995:105]. This somewhat exclusive distribution might suggest that Hi-Lo is contemporary with the Plano forms. In terms of actual settlement location, Deller's work (1976, 1979) suggests that the specific site locations chosen by Hi-Lo peoples are very much like those found in earlier fluted point times including well-drained elevated areas with southern exposure, which often overlook lower, wetter areas of muck soils.

Age and External Relationships

There is no doubt that Hi-Lo is an early dating, late Pleistocene to early Holocene development in the Great Lakes region. As noted above, lithic procurement and reduction practices and virtually the whole tool kit, are essentially identical to that of definitive early material such as that found on fluted point and Holcombe sites in the Great Lakes region. Even accepting this fact, however, more specific estimates of the age of Hi-Lo materials have varied over the time since those materials were first reported.

Fitting (1963a:1) first argued that Hi-Lo was a Late Palaeo-Indian manifestation that post-dated fluted points. He later revised his thinking on the matter and suggested that Hi-Lo was actually a fluted point form (Fitting 1970:42). Still later, he again began to view it as a Late Palaeo-Indian, immediate post-fluted point development (Fitting 1975:xiii). Subsequent researchers have tended to follow this last interpretation (e.g. Mason 1981) and to make arguments for more specific temporal placements and external relationships to sites outside the Great Lakes region. To my knowledge, Shay (1971:70) was the first investigator to suggest a possible relationship between Hi-Lo and Dalton materials found farther south, and Ellis and Deller (1982) concurred in this assessment (although one can also argue that at least the "Hi-Ho" forms have closer resemblances to Quad and other Late Palaeo-Indian forms found in the southeastern United States which presumably just pre-date Dalton [see Mason 1962]). In any case, Ellis and Deller (1982:16–17) elaborated a wide range of tool kit and lithic tool production strategy similarities (such as the probable production of small blades) to Dalton. Particularly notable, was the fact that Hi-Lo points like Dalton points are heavily resharpened laterally, usually by alternate beveling, often have a distinct stem prior to lateral resharpening, grade into side-notched forms, and exhibit the same range of recycling, including transformation into very distinctive forms by the addition of small "needle gravers" at the tip or the beveling on only one lateral fore-section edge (for example, compare Figure 3 with Goodyear [1974] and Painter [1985: Figure 4]). The only major difference is that Daltons tend to be serrated and have strictly unifacial edge beveling whereas Hi-Lo's lack serrations and can have some bifacial retouch selectively applied in beveling. In the absence of serrations, strict unifacial beveling would result in a steeper, thicker edge with continued resharpening. Therefore, one suspects that a selective bifacial retouch was applied by Hi-Lo knappers in order to maintain a sharper edge for a longer period of use.

The specific age of Dalton is much debated, perhaps because, as with Hi-Lo, there is a very broad range of point forms that have been placed under the Dalton rubric. These range from some items which seem to be, in terms of morphology and production techniques, close to fluted points (see, for example, Bradley 1997:55) to items such as those assigned to the Greenbrier Dalton type, which are essentially side-notched (e.g. DeJarnette *et al.* 1962: Figure 47). Most investigators follow Goodyear's (1982) lead and argue unnotched forms of Dalton are best dated to ca. 10,500 to 10,000 B.P. and that the notched forms represent the earliest side-notched points of around 10,000 B.P.

Given the overwhelming similarities of at least classic Hi-Lo and side-notched Hi-Lo to the Dalton forms, a comparable age seems the most reasonable alternative. However, recently, there have been suggestions by some that what seem to this author to be no more than

Hi-Lo points (including all the sub-types defined herein) and Holcombe points, date much earlier. In particular, based largely on surface collections from southeastern Wisconsin, Overstreet (1993) has proposed a "Chesrow" complex, which includes a wide range of point forms. Although the odd point from these collections appears to be fluted, the vast majority would easily fit into other previously, albeit in some cases, very loosely defined, unfluted, basally-thinned, concave-based point categories, including types or sub-types such as Holcombe, Hi-Ho, Classic Hi-Lo and even side-notched Hi-Lo. This author (and others; e.g. Mason 1995:240–241) sees no reason to regard them as anything other than as points of the previously defined types.

The suggestions of a greater age for "Chesrow" complex materials is based on the more recent, very important recoveries at some southeastern Wisconsin sites of stone tools in association with mammoth remains. These animals became extinct some time early in the 11th millennium B.P. (see Meltzer and Mead 1985); the Wisconsin sites have ^{14}C dates ranging from 10,900 B.P. to in excess of 12,500 B.P. (Overstreet 1996, 1998). However, none of the recovered stone artifacts from these sites are diagnostic projectile points. The attribution of the sites to the "Chesrow" complex is based solely on the raw materials used and the rarity of any definitive fluted point sites in the area. I am exceedingly wary of using either of these sources of data to support such an argument. In my opinion, the detailed projectile point similarities between Hi-Lo points and their variants and Dalton materials make it much more likely all or most of the Chesrow point forms date towards the end of the 11th millennium B.P., and are not associated with the mammoth kills/butchering localities. In fact, Chesrow forms (and Hi-Lo's) are very common in comparison to fluted point forms. If point/site frequency can be correlated with population, it seems more logical to assume the earliest occupants would be at lower population densities than later groups. Acceptance of this reasoning would be more consistent with fluted points representing the earliest occupations.

One should also note in this context that an unfluted lanceolate point was recovered from the lowest levels at Meadowcroft Rockshelter, which is argued to be pre-fluted point in age (Adovasio *et al.* 1999). This point has: a relatively thick cross-section, an apparent slight stem remnant or "nubbins" at the juncture of the base and fore-section, an unpatterned facial flaking, and an asymmetrical fore-section which appears to be heavily laterally resharpened. In sum, I find it very difficult to distinguish from a Classic Hi-Lo. Moreover, small formal blades occur in the lowest level at Meadowcroft, and Adovasio *et al.* (1999) have argued these are technological and not just morphological blades. If one accepts these similarities and the dating of Meadowcroft, one could again argue that Hi-Lo might indeed be pre-fluted point. However, given the large number of reported Hi-Lo findspots, the numerous similarities to Dalton, and the clear presence of notched Hi-Lo examples, this scenario seems unlikely. In any event, Adovasio *et al.* (1999:418) have gone so far as to suggest that an association of lanceolates resembling the Meadowcroft find and small blades, is not found on post-fluted point sites, and they use this evidence to bolster arguments that Meadowcroft is pre-fluted point in age. However, while not yet conclusive, the evidence for a blade industry from Hi-Lo, seems at least as credible as the evidence (e.g. small sample of "blades" without the cores themselves) recovered from the Meadowcroft site itself. Also, as suggested above, the most reasonable interpretation with present evidence is that Hi-Lo is post-fluted point. Regardless, we still need to know much more about post-fluted point lanceolate assemblages in the Northeast in order to claim that Meadowcroft is distinctive and unlike such industries.

Accepting an age estimate of approximately 10,000 B.P. for Hi-Lo, and allowing for the fact that the Plano points found mainly in northern areas of southern Ontario resemble forms such as Agate Basin and Hell Gap (dated in the west to a comparable time – see Ellis and Deller 1986), we can argue that Hi-Lo and the Plano points are contemporary. As previously noted, the different overall distribution and concentration in southern Ontario of Hi-Lo and Plano forms also suggests they are at least partially contemporary.

Hi-Lo: Palaeo-Indian or Early Archaic or Why Notch?

Let me state at the outset that I have no vested interest in regarding Hi-Lo as either Palaeo-Indian or Early Archaic. Rather my goal here is to review how others have used the term and whether I agree or disagree with their logic. Following Mason (1962), and although not necessarily for the same reasons, I have always referred to Great Lakes developments associated with lanceolate unnotched points, and including at least "Hi-Ho" and "Classic" Hi-Lo, to be Late Palaeo-Indian. In turn, I regard notched points such as the side-notched Hi-Lo forms as Early Archaic (Ellis *et al.* 1990:71).

This distinction is based on the assumption that the boundary distinction between Palaeo-Indian and Archaic and other *very gross* classificatory distinctions *must be somewhat arbitrary*. It is simply a convenient "signpost" we can use to organize the archaeological record and measure change that has occurred – the introduction of notching on points is just such a signpost I use to distinguish the two. I should stress here as well that although I focus on points as the dividing or boundary marker, this focus does not mean I regard these items, and changes within them over time, as being of greater cultural/adaptational significance than other artifact forms or site characteristics. Rather, they are used as a convenient marker simply because of a combination of the facts that they appear to: a) change through time more rapidly than other items; and b) to be more widespread spatially, thus allowing one to tie together temporally otherwise diverse geographic sequences. In sum, they can provide the most refined chronology with the widest geographic applicability. Note that this also does not mean I regard Palaeo-Indian as a simple temporal distinction. In fact, because I believe notched points were contemporary with lanceolates in different geographic areas, as in the contrast between the upper and lower Great Lakes area, I do not regard Palaeo-Indian or Archaic as a time distinction (see for example Ellis *et al.* 1990). Therefore, my model is not a temporal one in the sense of Stoltman (1978). Instead, I regard the framework I use as a "formal" one defined on the basis of characteristics of the artifact/site record irrespective of what the significance may be of these characteristics in temporal or cultural/adaptive terms. In turn, I prefer to refer to Palaeo-Indian and Archaic as a kind of grand scale technological "tradition" (a formal designation following Willey and Phillips [1958:34–38]) rather than as "periods" (a purely temporal designation) or stages (defined on inferred cultural characteristics following Kreiger [1953:247]).

Others, such as Griffin (1964:225–227, 1983:245), also view the distinction between Palaeo-Indian and Archaic as a somewhat arbitrary convenience. Griffin (1952, 1983:245) tends to view Palaeo-Indian as a "period" implying it is primarily a temporal rather than a formal or adaptational/cultural distinction, although one can question the idea that his distinction is purely or even largely a temporal one (see Stoltman 1978:709–711). Regardless, and unlike me, Griffin (1964, 1983) arbitrarily draws the boundary between Palaeo-Indian and Archaic on the basis of the disappearance of fluting instead of the appearance of notching. Since I also regard the use of notched points as an arbitrary and convenient distinction between Palaeo-Indian and Archaic, I can hardly disagree with Griffin's (1964, 1983) logic. My attitude in this regard is: "to each his own" as long as one is explicit about how the terms are used.

Still others, however, tend to somehow view the distinction between the latest Palaeo-Indian and earliest Archaic in more adaptational and cultural terms instead of in terms of simply a formal distinction or a temporal one. Mason (1962; see also Mason and Irwin 1960:55) sees a uniformity in stone tool forms as characteristic of Palaeo-Indian, implying a formal distinction, but also stresses the idea that Palaeo-Indians had a single lifeway, namely that of big-game hunting. Hence, in his view, the lanceolate point users were Palaeo-Indians and not Early Archaic. Cleland (1966:48–49) apparently disagrees with the idea that unfluted lanceolate point users were big-game hunters and sees the evidence as indicating Great Lakes lanceolate point users were adapted more to forested areas in contrast to earlier fluted point users. Hence, he would place Mason's (1962) Late Palaeo-Indian into the Early Archaic. These sorts of discontinuities highlight to me the problem with using things such as inferred subsistence patterns to actually define Palaeo-Indian. This is a concern regardless of whether or not these inferences are meant to be used for temporal models, as in Stoltman's (1978) case, or in the cultural/adaptational terms as employed by investigators such as Mason (1962) or Cleland (1966). In sum, investigators seem unable to agree on just what the lifestyle or culture was of Palaeo-Indians. It is for this reason, among others, that I am unwilling to employ cultural/adaptational distinctions as *defining* criteria (e.g. Ellis and Deller 1990:37–38).

In any event, even more recently we have had other discussions of what distinguishes Palaeo-Indian and Archaic in cultural terms and specifically, discussions of where Hi-Lo fits in this mix, notably by Wright (1995). Wright (1995:71–73) has relegated Hi-Lo materials as a whole to the Early Archaic. This is despite the fact that other material traditionally called Late Palaeo-Indian by some, including assemblages with point forms resembling those in western North America such as Agate Basin, are placed by Wright (1995:96–120) into a "Plano Culture," separate from Palaeo-Indian and Early Archaic. Wright (1995) marshalls support for the distinction of Hi-Lo based on the idea that there are significant differences between Hi-Lo and fluted point/Plano point producing groups. In particular, he attributes the switch in point forms, including the introduction of thicker points with notching and stemming, to a "dramatic change" in weapon systems. These include the introduction of the spearthrower or atlatl as a replacement for earlier hand-held thrusting or throwing spears, which presumably indicates a major change in lifestyles (Wright 1995:65, 72). The idea that the change in points represents a major change in lifestyle has a respectable history (e.g. Caldwell 1958:13) and the idea that notched points in particular represent the introduction of the atlatl is echoed by other investigators (e.g. Gardner 1977:258; Roosa 1977:90). However, I have at least three interrelated problems with this specific argument.

First, preserved spearthrower remnants are reported from Late Palaeo-Indian/Plano sites in the west (e.g. Wheat 1976:11–12), showing an absence of notching or marked stemming, is not an indication of the absence of spearthrower use. Second, and related to this first problem, none of those arguing (or rather *asserting*) that notching, thickness, etc. are evidence of the use of the atlatl have provided any theoretical arguments linking the attributes seen on points to the use of different weapon systems. Why, for example, must a point used with an atlatl dart have to be notched and a hand-held/thrown spear unnotched? In such a situation, the idea that notching and other changes represent atlatl use is simply a personal opinion unsubstantiated by any supporting bridging argument linking the facts of the archaeological record to the behavioural inference. Third, and finally, it is possible to suggest other possible alternative arguments as to why the changes occurred in point form over time and unlike the atlatl argument, it is possible to provide supporting bridging arguments linking the archaeological record to tool function. This last point needs more extended discussion.

There is no doubt that Hi-Lo and related forms represent a change from earlier point styles. There is also no doubt, in the form of recovery of many Hi-Lo points with extensive tip impacts (e.g. Figure 3.7) that these points were used as projectile tips. However, with the appearance of points such as Hi-Lo, there is also abundant evidence for the use of points in tasks other than as projectile tips, such as knives or the recycling into other hafted tools including drills, end scrapers and other forms. In contrast, there is little or no evidence that earlier points were designed and used, except in a more expedient and almost always unhafted manner (e.g. Ellis and Deller 2000:89–91), as other kinds of tools. There is also almost no evidence for the lateral fore-section resharpening of fluted points as seen in Hi-Lo,

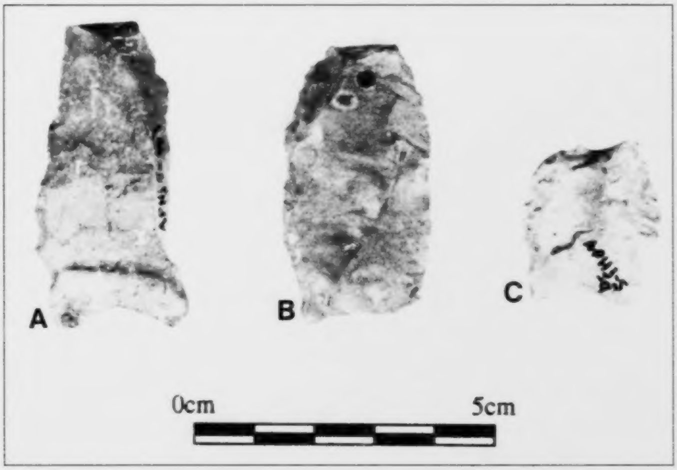


Figure 3.7 Heavily Tip-Impacted Hi-Lo Points. a: Bayport chert, Welke-Tonkonoh Area A; b: Kettle Point chert (subsequently recycled into simple side scraper), Welke-Tonkonoh Area A; c: Haldimand chert, Welke-Tonkonoh Area D.

which would indicate a design for, and extended use as, knives – an argument made forcibly several times by Goodyear (e.g. 1974:103, 1982:383) in his discussions of differences between Dalton and fluted points. This more heavy duty use as seen in Hi-Lo clearly would require more robust forms with more pronounced cross-sections, thicker ears and even the very extensive grinding seen on Hi-Lo points (see Goodyear 1974:32–33).

Similarly, if Hi-Lo points were mounted in short fore-shafts that doubled as handles for non-projectile use and as spears or dart fore-shafts, their use as knives and for other non-projectile tip purposes would require a stronger anchor of the tool to the handle or separate fore-shaft, most particularly, to prevent the point pulling from the shaft. Notching and stems with slightly concave side margins would provide a more secure means of binding in this manner (Springer *et al.* 1977:294–296). Notching and stemming also allows one to move the binding away from the side edges of the tool such that the binding would not interfere with, or be damaged by, the back and forth movement of those edges when used as knives. In fact, notching/stemming allows extensive reduction in width, through resharpening of the fore-section edges, without encroachment on the binding at the base. Also, notching and stemming allow one to continue to use the tips as effective projectile tips in addition to maximizing their use as knives. Experimental studies have consistently shown that the binding projecting from the sides of projectile tips can actually inhibit penetration (e.g. Frison 1991:293; Pope 1974:56). This binding is removed from harm's way by notching or stemming such that even if the lateral edges are resharpened the binding will still not project. Overall, all characteristics of Hi-Lo points, whether it be stemming, notching, thickness, or thicker and more robust ears, can be seen very easily to relate to changes in point use contexts over time. The changes range from a point designed more as a projectile weapon tip in fluted point times, to a point designed to be used for a much broader range of hafted tasks, including continued use as an effective projectile tip. There is no need to invoke a switch to the use of the spear-thrower to explain these changes.

Just why there should be a change to a multi-purpose tool by Hi-Lo times is unknown. There is little doubt that this change occurred between fluted/Holcombe points and Hi-Lo. However, if we are going to accept cultural reasons for distinguishing Palaeo-Indian and Archaic rather than using the distinction simply as a convenient time marker, does this change alone mean that Hi-Lo should therefore be regarded as Archaic instead of Late Palaeo-Indian? I think not because, unlike Wright (1995), I see no evidence for "dramatic change" between fluted point materials *as a whole* and developments such as Hi-Lo. Indeed, except for the changes in point forms, virtually every aspect of Hi-Lo, whether it be the tool kit, lithic procurement practices, tool production strategies including core forms, or site size, layout and location, is comparable to that seen on what everyone regards as Palaeo-Indian sites. These aspects also contrast with what everyone (excepting perhaps Gardner [1977]) would regard as Early Archaic, such as sites of the Corner-Notched point horizon (see Table 3.1). Excluding the reduction in end scraper size, and, perhaps, the presence of large biface knives ground along one edge, there are only a few aspects that definitive Early Archaic sites in Ontario (like Nettling) have in common with Hi-Lo sites. These include excellence in tool manufacture and use of stone materials carried in from some distance. These traits are also ones which are found on all earlier sites, not just Hi-Lo ones, and therefore, provide little

Table 3.1 Hi-Lo in Relation to Palaeo-Indian and Early Archaic

Characteristic	Early Palaeo-Indian	Hi-Lo	Early Archaic (corner-notched horizon)
Use of notched/ stemmed points	No	Yes	Yes
Use of primarily one, often exotic, chert source	Yes	Yes	No
Heavy reliance on primary chert outcrops	Yes	Yes	No
Heavy reliance on standardized core reduction	Yes	Yes	No
Use of large biface cores	Yes	Yes	No(?)
Use of conical cores	Yes	Yes	No
Use of backed bifaces	Yes	Yes	No
Use of twist drills	Yes	Yes	No
Use of spurred/notched end scrapers	Yes	Yes	No
Use of end scrapers with "all-over" dorsal flaking	No	No	Yes
Use of smaller, more fan-shaped end scrapers	No	Yes	Yes
Extensive use of side scrapers	Yes	Yes	No
Use of ground stone tools	No	No	Yes
Use of heavy duty, hafted, formal wood-working tools	No	No	Yes
Use of bannerstones	No	No	Yes(?)
Large multi-area sites	Yes	Yes	No
High density of debris	No	No	Yes
Concentrations of sites in elevated areas near muck soils	Yes	Yes	No(?)

basis on which to separate out Hi-Lo from the earlier developments. Hi-Lo is like every other Palaeo-Indian development in the area in every trait except for the form/use context of the points, and therefore, it seems exceedingly perverse to me to call it anything other than Palaeo-Indian, whatever the specific meaning of those traits may be in cultural/adaptational terms.

There is much more overall evidence for continuity rather than change, and I would be reluctant to see the simple change in projectile points as being one which is somehow more significant in cultural/adaptational terms than other changes we can document as occurring in this time frame. In sum, I am not convinced it is of any more significance than the other limited changes, which occur at the time. For example, there are changes in end scrapers seen in these assemblages which potentially might be of more cultural significance than the point form changes. Corner-notched horizon end scrapers have lots of all over extensive dorsal surface flaking as do even Plano forms (see, for example, Dibb 1985: Plate 5:6; Julig 1994: Figure 5.27a, b; Stewart 1984: Figure 8, upper right), whereas fluted and Hi-Lo end scrapers do not. Such variation clearly relates to changes in primary production technology, such as the shaping of tool blanks on the core versus shaping after detachment from the core. In addition, there are many who have argued that these sorts of changes in core reduction strategies signal changes in mobility, lithic procurement strategies, etc. (e.g. Johnson and Morrow, editors, 1989). One might as well claim, therefore, that this signals a major cultural change and should be used to group Hi-Lo with fluted point materials as "Palaeo-Indian" and Plano with notched point materials as "Early Archaic." In a similar vein, one could even argue that the probable appearance and use of a "small blade" technology in Holcombe and Hi-Lo is of such significance that these two units together should be singled out as something different from either Palaeo-Indian or Archaic – perhaps as a "Terminal Palaeo-Indian"?

In any case, if I was forced to argue for significant cultural changes as driving my Palaeo-Indian/Archaic distinction, it seems to me that it would be better to rely on situations where multiple changes occur. For example, the change from side to corner-notched points around 9,500 B.P. seems to be accompanied in southern Ontario by the introduction of heavy woodworking tools, ground stone tools, atlatl weights, use of unstandardized core reduction procedures, extensive use of secondary toolstone deposits, and so on. We do not know the reasons for, or cultural significance of, many of these changes. Nonetheless, simply the breadth and scope of the observed changes suggests to me these were more significant than simply the appearance of notched points. Of course, this assumes one knows all regional early side-notched developments well (which we do not!), that they are the same as side-notched Hi-Lo in terms of artifact assemblages, and that they all contrast with the corner-notched horizon materials in these regards.

It has been suggested to me in conversation that it might be possible to argue that Hi-Lo is best regarded as Archaic because unlike some other lanceolate point developments, there is clear evidence of stylistic continuity from Hi-Lo into the notched point industries in at least the form of points. For example, the presence of side-notched Hi-Lo points suggests that Hi-Lo leads into the point forms of the subsequent Early Archaic, whereas it is difficult to see any genetic relationship between the Hell Gap-like and Agate Basin-like Plano forms seen in Ontario and subsequent notched point forms. However, once again I do not find this a convincing argument. The reason is that it is possible stylistically to trace Hi-Lo point forms from fluted point forms like Crowfield via the intermediate Holcombe point form and therefore, argue that fluted point assemblages eventually gave rise to Hi-Lo and in time, the notched forms of the Early Archaic. However, one cannot easily trace stylistically a development of Agate Basin-like and Hell Gap-like, and other Plano points, from earlier fluted point forms. Therefore, carrying this logic to its extreme, since fluted point developments in the area can be linked in a stylistic point train into the Early Archaic whereas the Agate Basin and other Plano forms cannot, we would have to regard fluted point assemblages as Early Archaic. I doubt if there are any investigators willing to make such an argument.

Summary and Conclusions

To summarize, I believe we have made significant progress over the last 10 to 15 years, determining certain aspects of Hi-Lo, including the nature of the overall stone tool kit, and understanding the range of variation in, and sources of variation among, Hi-Lo points. Not as well understood are the lithic procurement and core reduction practices, but at least some information is now available. I remain convinced that the closest development to the Hi-Lo complex outside the Great Lakes area is to be found among Dalton to the south. Therefore, the age of Hi-Lo is somewhere around 10,000 B.P. Present data suggest that there are few differences between Hi-Lo complex materials and earlier fluted point materials and more differences between Hi-Lo and definitive Early Archaic material, although I concede this may be more a result of limitations on our knowledge than of actual fact. While I may have some ideas regarding the causes of such temporal variation in cultural/ adaptational terms (see for example, Ellis *et al.* 1998), I certainly do not feel that we really have any final major understanding of the significance of these changes, including those which arrive with Hi-Lo. Thus, I am not convinced that we should a) regard these changes as being of lesser or greater significance in cultural or adaptational terms; and b) use this sort of evidence to derive our gross classificatory units such as Palaeo-Indian and Archaic and especially, in deciding where we can draw precise lines between the two.

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4.

Intensity of Land-Use Around the Holland Marsh: Assessing Temporal Change from Regional Site Distributions

Andrew M. Stewart

Abstract

Pre-contact settlement around the Holland Marsh – a late glacial lake embayment and Holocene wetland draining into Lake Simcoe in central southern Ontario – is mapped using existing site survey records and diagnostic artifacts. Surveys following the glacial lake strandline were designed to find Palaeo-Indian sites, based on the assumption that Early Palaeo-Indians were attracted to the shore of this lake. Palaeo-Indian sites, found mostly at the south end of the marsh/lake-embayment, dominate the entire record for the area. Spring caribou hunting may offer one explanation for spatial clustering during the late glacial period. During the Holocene, small, scattered Early Archaic sites are succeeded by larger, fewer Middle Archaic sites. The prominence of these Archaic sites within the Holland Marsh area supports the view that large, stable wetlands were important environments for Early Holocene foragers in the lower Great Lakes.

Résumé

Compte tenu des reconnaissances archéologiques et des objets-témoins directeurs, on localise sur carte géographique les établissements qui, antérieurs à la période de contact, se situent dans la région de Holland Marsh, anse d'un lac glaciaire tardif et marécage de l'holocène qui se draine dans le lac Simcoe au centre sud de l'Ontario. Les reconnaissances effectuées sur les anciennes terrasses du lac glaciaire visaient à trouver des sites paléoindiens en vertu de l'hypothèse que les Paléoindiens inférieurs convoitaient le littoral de ce lac. Les sites paléoindiens dominent en effet tout l'enregistrement de cette région. La chasse printanière au caribou à la fin de la glaciation est une des explications susceptibles de justifier le regroupement spatial des sites à l'extrémité orientale de ce marécage/anse du lac. Durant

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l'holocène, les sites de l'Archaïque inférieur, petits en nombre et en taille, précèdent des sites, en nombre plus réduit mais de taille plus grande, remontant à l'Archaïque moyen. La proéminence de ces sites archaïques dans la région de Holland Marsh renforce l'opinion voulant que les grandes étendues stables de sols humides constituaient des milieux favorables à l'acquisition de la nourriture dans les inférieurs Grands-Lacs.

Introduction

The Holland Marsh, situated within the Simcoe lowlands north of the Oak Ridges moraine, has been a focus of settlement for people living in central southern Ontario for the past 11,000 years. Following the retreat of Laurentide ice, this finger-like lowland was inundated, forming an embayment of a pro-glacial lake, which lasted until about 10,400 B.P. (Figure 1; Karrow *et al.* 1975). Palaeo-Indian sites are located on, or above, the level of this lake at the southern head of the embayment and demonstrate early aboriginal use of this area (Stewart 1984; Storck 1982). The riverine wetland that succeeded the lake-embayment continued to attract people, as shown by the presence of mostly Archaic sites. If size is an indication of biological productivity and diversity, then the Holland Marsh, like other wetlands in the Northeast and Great Lakes region (Kuehn 1998; Nicholas 1998a, 1998b), was an important foraging ground throughout the Holocene. Its importance is reinforced by the presence of remnant prairie habitat that supported nut-bearing trees around the edges of the marsh (Reznicek and Maycock 1983). As a southward extension of the Simcoe lowlands into the moraine, it represents an ecotonal area of diversity between lowland and upland environments.

These attractive qualities would have been enhanced in the changing environment of the early (10,000 to 8,000 B.P.) and middle (8,000 to 4,000 B.P.) Holocene. Contributing to uncertainty and change during the early Holocene were fluctuating lake levels (Lewis and Anderson 1989; Lewis *et al.* 1994) and forest succession (Bennett 1986; McAndrews 1985; Muller 1999; Szeicz and MacDonald 1991). During the middle Holocene, warmer and dryer conditions in southern Ontario, which were part of a continental pattern of Hypsithermal warming (Edwards and Fritz 1988; Wendland 1978), may have created new kinds of stresses for hunter-gatherer populations. During this time, wetlands likely persisted in the Holland Marsh, as they did in the Minesing Swamp to the west (Figure 4.1), though short-term drying and soil development may have occurred around its edges (Fitzgerald 1985). There are several reasons, therefore, why the Holland Marsh can be considered a particularly important setting for human occupation, especially from 10,000 to 6,000 B.P. These include, its biological value based on areal extent, its proximity to prairie habitat, and its relative stability within a region susceptible to changes in water regime – fluctuations in lake levels to the north and shrinkage of smaller water bodies within the moraine uplands to the south.

Regional surveys for Palaeo-Indian sites around the Holland Marsh embayment in the 1970s and 1980s (Dibb 1985; Prideaux 1977; 1978; Stewart 1982; Storck 1979) provide an opportunity to examine the question of potential changes in settlement through time around the marsh. More specifically, this chapter addresses two questions: (1) How did size, placement, and frequency of sites change around this lowland as the environment evolved from

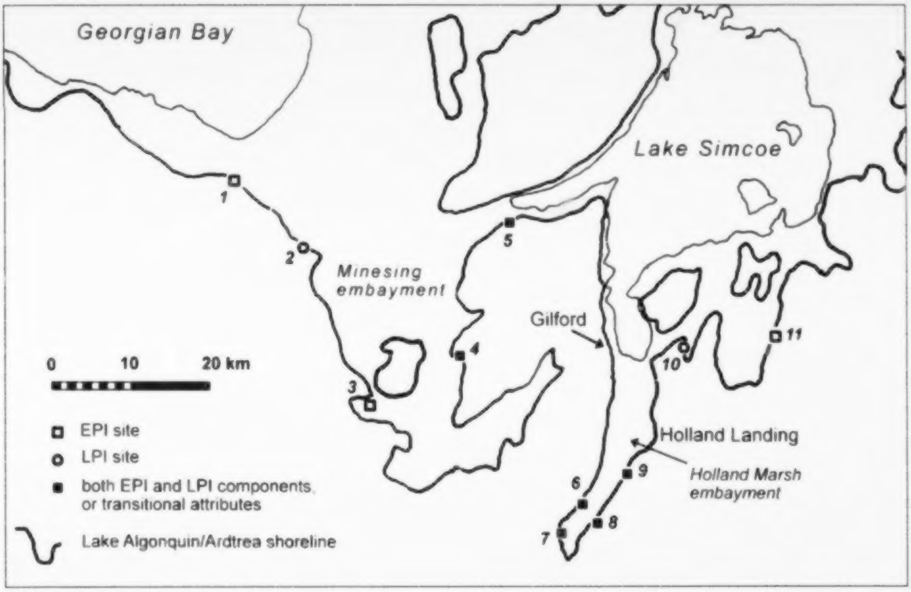

Georgian Bay
Lake Simcoe
Minesing embayment
Gilford
Holland Landing
Holland Marsh embayment
0 10 20 km
☐ EPI site
○ LPI site
■ both EPI and LPI components, or transitional attributes
Lake Algonquin/Ardtrea shoreline
1
2
3
4
5
6
7
8
9
10
11

Figure 4.1 Location of the Shoreline of Glacial Lake Algonquin or Ardtrea in Central Southern Ontario Showing the Holland Marsh Embayment. The 1982 shoreline survey extends between Gilford and Holland Landing. Palaeo-Indian sites, shown by period (EPI, Early Palaeo-Indian; LPI, Late Palaeo-Indian) are: 1 .Fisher (Storck 1997); 2. Coates Creek (Storck 1978); 3. Banting (Storck 1979); 4. Hussey (Storck 1979); 5. Fowler (Woodley 2000); 6. McMillan; 7. Boag; 8. Zander; 9. Sisler; 10. Deavitt (Dibb 1985); 11. Udora (Storck and Spiess 1994).

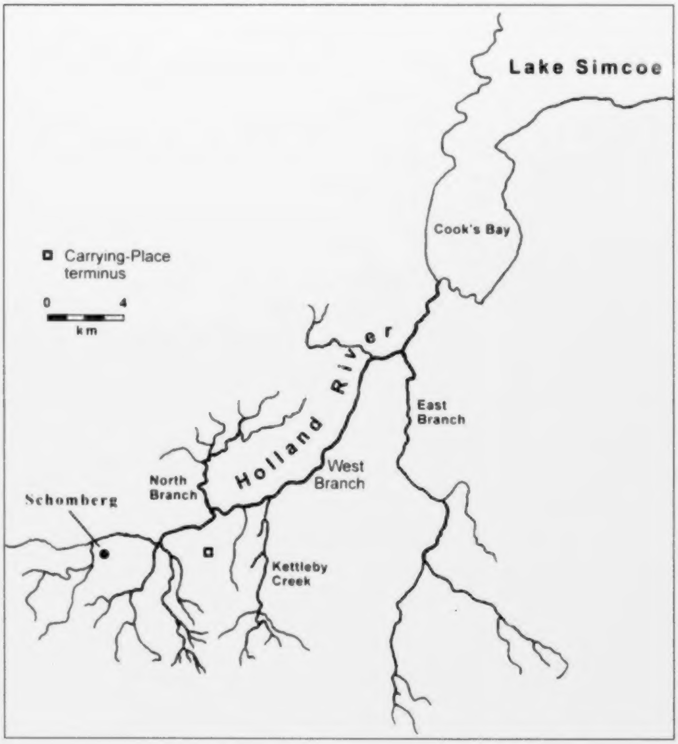
open water to marsh during the early post-glacial and early Holocene?, and (2) How does the record of early and middle Holocene land-use, representing the period of greatest environmental change, compare to that of later use? Settlement data for the Holland Marsh region ultimately needs to be compared to data for other comparably surveyed wetland complexes. Examples of these wetlands could include, the Thedford embayment on the Ausable River (Deller and Ellis 1992; Ellis and Deller 2000), or wetlands associated with headwaters of rivers such as the Grand or Thames (Lennox 1993), as well as non-wetland areas where early Holocene surfaces are intact and exposed.

Environment and Archaeological Record

Holland Marsh occupies the lower Holland River basin, a drainage of nearly 600 km^2, which flows from the slopes of till uplands that surround the marsh, particularly on its southeast side, northward into Cook Bay of Lake Simcoe (Vallery *et al.* 1982: Figure 2 and 3). Prior to the 20th century, when it was drained for agriculture, the marsh extended for about 35 km on either side of the river and was up to 3 km wide.

The lowland occupied by Holland Marsh represents an embayment of main-stage glacial Lake Algonquin or, possibly, Lake Ardtrea (Jackson *et al.* 2000) existing between 11,200 and 10,400 B.P. (Figure 4.1). During the early Holocene, it probably evolved from lake to fen or marsh, similar to neighbouring embayments: Rose Swamp, occupying the Muskinonge River to the east (McAndrews 1985), and the much larger Minesing Swamp, occupying the upper Nottawasaga River to the west (Fitzgerald 1985; Karrow *et al.* 1975). When Palaeo-Indian hunter-gatherers lived in this area, it was likely an open water embayment of Lake Algonquin/Ardtrea, though Late Palaeo-Indian peoples may have been camping on a recently abandoned strandline overlooking an early emergent wetland. This wetland, like others in the northern temperate world (cf Kuehn 1998; Coles 1998), could have been a core area for subsistence throughout the Holocene. It may have served as a seasonal or year-round source of fish, likely procured, in part, at weirs built across the river's mouth (Heidenreich and Burgar 1999:74). Other sources of food might include molluscs, amphibians, reptiles, waterfowl, fur-bearers and larger terrestrial mammals, and plants, for local inhabitants and

Figure 4.2 Holland River drainage prior to canalization showing approximate location of the north end of the Carrying Place trail on the south side of Holland Marsh.



people at more distant settlements, such as the Iroquoian Beeton site, on the surrounding divide (Latta 1980).

The Toronto Carrying-Place trail used to bring travellers over the Oak Ridges moraine uplands from the lower Humber River on Lake Ontario to a point on the Holland River just upstream from where the West Branch and the North Branch join (Figure 4.2). The trail was an important overland passage between the lower and upper Great Lakes, at least from the late pre-contact era until the late 18th century, and is associated with several Iroquoian sites dating to the 16th century or later (Austin 1995). Some dimensions of the original Holland River channel are indicated by annotations to a map made by Deputy Surveyor-General Collins in 1790. He indicated that the river was about 10 m wide and 2 m deep at the trail terminus, widening to 25-to-30 m and deepening to 6-to-7 m at the mouth of the river on Cook Bay (Robinson 1965:204). Since the 1920s, the lower West Branch has been replaced by canals. The river, "formerly the haunt of giant muskellunge, is now [in 1932] an empty channel" (Robinson 1965:205). The marsh has been drained and, at least 1.5 m of peat deposits have been lost to intensive agriculture (Blakey and Litteljohn 2000; Chapman and Putnam 1984). Peat, overlying sand and clay, was once 2 to 3 m deep at the southern end of the marsh, where Highway 400 was constructed through it, and deeper further downstream (Chapman and Putnam 1984:181; Gwyn and White 1973). This wetland environment included eastern white cedar swamp and stream-fed fen near the river, and nutrient-poor shrub bog in drier areas further inland (NWWG 1988:225; Chapman and Putnam 1984). Mrs. Simcoe, writing about her husband's trip from Lake Ontario to Lake Huron in the fall of 1793, described the wetland as "a terrible bog of liquid mud" (Robinson 1965:187). Today, small areas survive as a graminoid-type fen (NWWG 1988:209).

Summary of Archaeological Work Around the Holland Marsh

During the 1970s and 1980s, archaeological surveys were made along elevations which correspond with a highly convoluted section of the glacial lake strandline. This strandline, formed by Lake Algonquin/Ardtrea (Figure 4.1) skirts the Minesing Swamp and Holland Marsh and smaller former estuaries to the east (Dibb 1985; Prideaux 1977, 1978; Stewart 1982; Storck 1979). The aim of these surveys was to find Palaeo-Indian sites associated with this lake, which dates to between 11,200 and 10,400 B.P. (Karrow *et al.* 1975), or with the emerging wetland plain which succeeded it. The main elevation associated with this strandline is 228 m above sea level. Most of the survey effort was focused on ploughed fields at and just above this elevation, though parts of a higher, earlier possible strandline were also surveyed. This chapter considers the results of a subset of this regional effort, including part of the 1974 survey (Storck 1979:88-100), part of the Prideaux (1977, 1978) surveys, and all of the Stewart (1982) survey. It encompasses a section of the main strandline extending west from Holland Landing around the marsh to Gilford (Figure 4.1), representing about 90 km of convoluted fossil lake shoreline. Over this distance, a total of about 12 km^2 of fields was surveyed in 1982, within three km of the main strandline: three km^2 below the 228 m contour and 9 km^2 above. A total of 41 sites were located (and several others re-located and surveyed), of which seven were identified as containing diagnostic Palaeo-Indian material. More recently, contract work has identified another Palaeo-Indian site (Woodley 1999) and a more extensive occupation at the Zander site (ALL 2001). In the early 1980s, attention was focused on the Palaeo-Indian material (Stewart 1983, 1984) but the large number of other sites, many with Archaic material, suggested the need to examine Holland Marsh as a setting for human settlement during the entire Holocene.

A total of 22 sites around the marsh have produced diagnostic projectile points, allowing them to be assigned to one or more cultural periods (Table 4.1) based on the temporal ordering of projectile point types in southern Ontario (Ellis and Deller 1990; Ellis *et al.* 1990). Palaeo-Indian affiliation is based on other diagnostic evidence at two sites – a channel flake at the Gunn site and a beaked scraper-spokeshave (Storck 1997:74) made of Fossil Hill chert at the Hunt site. The size of these collections is indicated in Table 4.2, which also shows the extent of investigation by different researchers. Table 4.3 shows the approximate temporal span of periods (in radiocarbon years) and the frequency of sites per one thousand years for each cultural period. "Plateaux" in radiocarbon calibration curves for the period between 10,600 and 10,100 B.P. have probably caused researchers to underestimate the duration of Palaeo-Indian cultural traditions in North America (Ellis *et al.* 1998:152; Fiedel 1999). Even with this limitation acknowledged, the Palaeo-Indian and Early Archaic periods still exhibit a high density or rate of settlement accounting for a significant part of the material record of this area (Table 4.3).

Site Distribution

Figure 4.4 (a to e) shows site locations around the Holland Marsh by cultural period. Spatial patterns in these data suggest several shifts in land-use or settlement through time and space. A concentration of settlement that centred on Kettleby Creek on the south side of the marsh during the Palaeo-Indian period shifted to an area centred on the North Branch tributary on the north side of the marsh during the Archaic period (Figure 4.4a and 4.4b; see Figure 4.2 for names of geographic features). The timing of this shift corresponds to the transition from the post-glacial to the early Holocene and the recession of the glacial lake embayment and its evolution to marsh or fen wetland. Late Palaeo-Indian land-use on the south side of the embayment evidently persisted however, through the initial period of lake shrinkage, assuming that the recession happened at about 10,400 B.P. and that lanceolate material was deposited only later (Ellis *et al.* 1998). A second pattern or trend is the reduction, through time, in the number of independent site locations around the marsh, following the Early Archaic period (Figure 4.4b to 4.4e). This reduction may reflect diminishing use of, or settlement on, the edges of the marsh. The only Woodland period occupation on the edge of the marsh is at the mouth of the North Branch. Some site contexts can be elaborated more specifically by cultural period.

Five Palaeo-Indian sites (3, 4 and 5 in Figure 4.4a) cluster on the southeast side of the marsh where Kettleby Creek crosses the 228 m contour. Several channels run parallel to each other through this area, emptying into a shallow, two km-wide embayment of the glacial lake shoreline. These channels may have been part of a wider, braided channel system of early post-glacial drainage, which originated from north-facing slopes on the south side of the Holland Marsh. The cluster of Palaeo-Indian sites that occurs here includes the only two

Table 4.1 Cultural Components Represented at sites by Diagnostic Artifacts; (?) Indicates uncertain affiliation.

Period	Projectile Point Traditions/Complexes	Site name and Borden number
PALAEO-INDIAN	unspecific	Gunn, BaGv-13 Hunt, BaGv-14 Cardinal, BaGv-44 Rogers-1, BaGv-27
EARLY	Gainey Crowfield	Zander, BaGv-7 Zander Sisler, BaGv-11
LATE	Holcombe	Zander Boag, BaGv-9 McMillan, BaGv-8
	Lanceolate	Zander Cardinal (?)
EARLY ARCHAIC	Side-Notched	Zander (?) Boag (?) Hodgins, BaGv-31 Muirhead, BaGv-19 (?)
	Corner-Notched	Gooding, BaGv-17 Leonard, BaGv-21 Kilmorlie-McMillan, BaGv-30 Cardinal (?) Boag
	Bifurcate Base	Kilmorlie-McMillan (?) Verkaik, BaGv-35 (?) Sumerville (Storck [1979] loc. 56
MIDDLE I	Stemmed	Verkaik
ARCHAIC II	Side-Notched (Laurentian: Vergennes)	Leonard Muirhead (?)
	(Laurentian: Brewerton)	Froud-McGuire, BaGv-15 Brown-1, BaGw-15 Gooding Cardinal (?) Boag (?)
	Ground Slate	Kilmorlie-Fraser, BaGv-24
LATE ARCHAIC	Narrow Point	Kilmorlie, BaGv-6
	Broad Point	Muirhead
	Small Point	Aitchison, BaGv-16 Boag McMillan
WOODLAND	unspecific (ceramics)	McMillan
	Meadowood	Mills-2, BaGv-29 (?)
	Jack's Reef	Brown-1
	(Late) Side-Notched	Brown-3, BbGv-13 Neilly, BbGv-15

Table 4.2 Size of collections and Extent of Work Performed on Sites with Diagnostic Artifacts

Site or Collection Name	Projectile Points	Other Worked Artifacts	Flakes and Fragments	Work Performed
Gunn	0	2	16	2 surveys (Prideaux 1977; Stewart 1982: site 124)
Hunt	0	3	9	1 survey (Stewart 1982: site 125)
Cardinal	1	7	635	49 m^2 excavated (Woodley 1999)
Rogers-1	1	0	0	1 survey (Stewart 1982: site 149)
Zander	44	184	1977	96 m^2 excavated (Stewart 1984) and numerous surveys
Tienkamp coll. (Zander site area)	9	0	0	unknown
Sisler	2	6	34	1 survey (Stewart 1982: site 122)
Boag	11	33	367	3 surveys (Prideaux 1977, 1978: localities 38 & 39; Stewart 1982: site 132)
McMillan	8	8	111	1 survey (Prideaux 1977: localities 34–36)
Hodgins	1	0	2	1 survey (Stewart 1982: site 157)
Muirhead	2	1	12	1 survey (Stewart 1982: site 136)
Gooding	3	2	0	1 survey (Stewart 1982: site 134)
Leonard	3	1	12	2 surveys (Storck 1979: localities 42 & 43; Stewart 1982: site 140)
Kilmorlie-McMillan	1	0	5	1 survey (Stewart 1982: site 153)
Verkaik	2	8	4	2 surveys (Prideaux 1978: locality 69; Stewart 1982: site 161)
Sumerville	1	0	2	1 survey (Storck 1979: locality 56)
Froud-McGuire	3	12	54	3 surveys (Prideaux 1977: locality 42; Storck 1979: localities 44–51; Stewart 1982: site 126)

Table 4.2 continued

Site or Collection Name	Projectile Points	Other Worked Artifacts	Flakes and Fragments	Work Performed
Brown-1	3	3	8	1 survey (Stewart 1982: site 129)
Kilmorlie-Fraser	1	6	36	1 survey (Stewart 1982: site 144)
Kilmorlie	4	5	18	2 surveys (Prideaux 1978: localities 61–66; Stewart 1982: site 146)
Aitchison	2	3	2	1 survey (Stewart 1982: site 127)
Mills-2	1	0	0	1 survey (Stewart 1982: site 152)
Brown-3	1	0	2	1 survey (Stewart 1982: site 150)
Neilly	1	0	1	1 survey (Stewart 1982: site 155)

excavated sites that contributed data to this study – the Zander and Cardinal sites (Table 4.2). Some of the smaller sites in this cluster are located well above the strandline, possibly on a higher and earlier pro-glacial lake shoreline at 244 m (Stewart 1984:47). Three other Palaeo-Indian sites are located elsewhere around the Holland Marsh embayment. The Boag site occurs on the upper West Branch of the Holland River at the confluence of three streams, east of the town of Schomberg (Figure 4.2), on an island or point of land at the head of the glacial lake embayment. The McMillan site is located on the north side of the marsh, at the outlet of the North Branch of the Holland River. Lastly, the Sisler site occurs downstream on the south edge of the marsh (Figure 4.4a).

A group of four, small Early Archaic sites (Figure 4.4b) are located on, or near, the outlet of the North Branch on the north side of the Holland Marsh (Figure 4.2). Settlement in the vicinity of the Boag and Zander site continues through this period. During the Middle Archaic (Figure 4.4c), settlement continues along the North Branch while expanding in the upper Holland Marsh area, on islands and points of land on both sides of the marsh. Evidence for settlement during this period disappears in the Zander site region on the south side of the marsh. Settlement during the Late Archaic period (Figure 4.4d) is sparser but the pattern is essentially unchanged from the previous period. Woodland period settlement (Figure 4.4e) represents a new pattern, with most sites located away from the marsh on higher ground to the north and south.

Observations of pattern-changes through time based on these 20 sites and site clusters (Figure 4.15) must be qualified by the fact that they are based largely on surface-collected material found during surveys, directed to a narrow band centred mostly on the 228 m con-

Table 4.3 Frequency of Sites or Components Around the Holland Marsh Attributable to Cultural Period, Duration of Period and Frequency of Sites per Millennium. Dates are given in 14C years and also in calendrical years for the Palaeo-Indian period, corrected for 'plateau' effect (Fiedel 1999:98).

Period	Site or Component Frequency	Period Range (thousands of years B.P.)		Duration (kyrs)	Site or Component Frequency per Millennium
		^{14}C kyrs	cal. kyrs		
Palaeo-Indian	8	11.5–10.0		1.5	5.3
Palaeo-Indian	8		13.5–11.4	2.1	3.8
Early Archaic	7–11	10.0–8.0		2	3.5–5.5
Middle Archaic	6–9	8.0–4.5		3.5	1.7–2.6
Late Archaic	5	4.5–2.8		1.7	2.9
Woodland	4	2.8 - 0.4		2.4	1.7

tour. Sites located below this band, in the marsh itself, possibly used during periods of low water, will have been overlooked by these surveys. Another source of bias is possible change in the geomorphological landscape over the course of the Holocene. Erosion and sedimentation along drainage channels may have affected the visibility of sites belonging to different periods. Small drainages, like the Holland Marsh tributary streams, might be subject to sediment flushing during periods when the climate was drier or when there was more intense storm activity, resulting in burial or removal of sites (cf. Artz 1995). Despite these restrictions on our ability to accurately perceive cultural patterning, survey data suggest an overall shift to more extensive land-use around the upper end and northwest edge of the marsh during the Early Archaic, followed by more intensive, concentrated land-use in later periods.

Site Components

Table 4.3 suggests that the Holland Marsh – particularly its south end – was most attractive to settlement during the Palaeo-Indian and Archaic periods, especially during the Early Archaic period, and it was used least during the Woodland period. This interpretation assumes that survey data around the Holland Marsh are representative of settlement or land-use in this area throughout the Holocene. During the Palaeo-Indian and Archaic periods, occupation or use persisted at several sites which may be said to be multi-component based on the presence of time-diagnostic artifacts from different periods at those sites (Table 4.4). These sites may have had stable environmental qualities, such as local resources or access to Holland Marsh, which attracted people, and therefore represented a stable wetland environment. Table 4.4 shows that of 10 multicomponent sites or site-clusters, five of these locations contain artifacts from contiguous or nearly contiguous periods. The diagnostic evidence from these five sites is described below.

The Zander site cluster (3, 4 and 5 in Figure 4.4a) includes projectile points that represent many of the Early and Late Palaeo-Indian types found in Ontario (Deller and Ellis 1988; Ellis 1994; Ellis *et al.* 1998; Storck 1984), except Barnes. The Zander site itself contains all of these types, as well as a side-notched point fragment, which may be from the earliest Archaic horizon. A possible Early Archaic corner-notched basal fragment was found nearby (Woodley

Table 4.4 Distribution of Diagnostic Artifacts at Multiple-Component Sites or Site Clusters. Legend: (x) artifact with diagnostic attributes of one complex or tradition; (o) artifact (represented by all 'o' symbols in same column) with attributes of more than one period; (?) artifact with less diagnostic attributes.

Period	Complex or tradition, evidence	Zander Cluster	Sisler	Boag	Mc-Millan	Muir-head	Kil-McM	Leonard	Gooding	Verkaik	Brown-1
E Palaeo-I	Gainey	x									
	Barnes										
	Crowfield	x	x								
L Palaeo-I	Holcombe	x		x	x						
	Stemmed Lanceolate	x	x								
Early Archaic	Side-Notched	?		o		o					
	Corner-Notched	?		x			o	x	x		
	Bifurcate Base						o			o	
Middle Archaic	Stemmed									o	
	Side-Notched/Vergennes					o		x			
	Brewerton	?		o					x		x
	Ground Slate										
Late Archaic	Narrow Point										
	Broad Point					x					
	Small Point			x	x						
Woodland	various, ceramics				x					x	

1999). This range of types represents a time span of perhaps 2000 radiocarbon years (Ellis and Deller 1990; Ellis *et al.* 1990). The Zander site is the only excavated site considered in this study, and so its high artifact diversity may not be considered unusual compared to other sites in the region which have only been surface-collected.

Representing the Early Palaeo-Indian period at the Zander site, three Crowfield-like fluted points were recovered in excavation (Figure 4 in Stewart 1984) and another, more recently, on the adjacent field to the west (AAL 2001). Several Crowfield and Gainey specimens are part of a private collection of projectile points, end scrapers, gravers and other tools collected in the 1940s from the Zander site and from fields to the east and west of the 1982 site excavations (Prideaux 1978). Some of the projectile points were loaned to the Royal Ontario Museum where they were photographed (Figure 4.5) and cast. One of the specimens shown in Figure 4.5 conforms to the Gainey type in its large size, basal concavity and parallel sides, and partial bifacial fluting that extends only halfway from base to tip. This point is one of at least two Gainey specimens from the Holland Marsh region; Garrad reported the other (1971: no. 42). Late Palaeo-Indian lanceolate forms, both unstemmed and with ground stems, are represented at the Zander site (Stewart 1983, 1984) and the private collection contains a distal section of one possible Holcombe point (Figure 4.5). Early or Middle Archaic forms are also present in this site cluster. A basal fragment of a side-notched point with prominent ears was recovered in test excavations at the Zander site (Prideaux 1978); and the base of a corner-notched point, which was broken through the neck, was found one km east at the Cardinal site (Woodley 1999). This site also yielded a graver, possible lanceolate point tip and other probable Palaeo-Indian tools made on Fossil Hill chert.

The Boag site has two Late Palaeo-Indian Holcombe point bases and several Archaic projectile point types within an assemblage of bifaces, unifacial tools and flakes (Prideaux 1977, 1978; Stewart 1982). Both of the Palaeo-Indian point bases are thinned several times on one face. The more complete specimen (Figure 4.6) is less than 5 mm thick with blade edges that expand towards the tip from a straight, unground base. A single thinning scar is parallel to one of these edges, instead of aligning along the central axis of the point. The thinness, shape and flake patterning of the base are suggestive of both Crowfield and Holcombe types, similar to other Palaeo-Indian specimens from the Zander and McMillan sites that appear to be distinctive of the Holland Marsh region (Storck 1982:11–12). The Early Archaic period is represented at the Boag site by two thin, regularly flaked, corner-notched specimens, one of which is serrated (Figure 4.7). A side-notched point (Figure 4.8) has several Early Archaic attributes, including alternate bevelling, serrations, a concave (almost bifurcate) base, prominent bifacial basal thinning and heavy grinding. It also has Middle Archaic characteristics, including a thick cross-section, irregular surface flaking and a broad, triangular outline. Crude serrated forms found in secure mid-Holocene contexts elsewhere in the Great Lakes area (Ellis *et al.* 1991:23), suggest that this specimen may be a Middle Archaic point. Other side-notched forms may be Early or Middle Archaic. A notched point (Figure 4.9) is probably part of the Late Archaic Small Point tradition (Ellis *et al.* 1990). Like the Zander site, the Boag site has a wide variety of raw materials: quartz and several types of chert, including Fossil Hill and Onondaga, possibly Lockport or Bois Blanc (represented by a notched point fragment), Kettle Point (a bipolar core) and Normanskill (a flake).

The Sisler site (Stewart 1982) is an Early and Late Palaeo-Indian site containing a Crowfield fluted point of Onondaga chert (Figure 4.10). The site is at the base of a slope just above the Lake Algonquin/Ardtrea strandline on both sides of an ephemeral or intermittent stream channel that fans out at the base of this slope. The fluted point was exposed in a gravel quarry where Palaeo-Indian materials may have been buried by mass wasting of slope sediments and by fan sediments from the channel. The multi-component McMillan site is in a similar setting on the other side of the marsh at the outlet of the North Branch (Figures 4.2, 4.3 and 4.4a). A fluted or basally-thinned point of Onondaga chert from this site (illustrated in Storck 1982: Figure 7c) has characteristics of both Crowfield (a thin cross-section, wide midsection, sides that expand markedly from the base) and Holcombe (basally-thinned, rather than fluted) forms (Ellis and Deller 1990). The McMillan site also contains a Late Archaic expanding stem point belonging to the Small Point tradition and Woodland period ceramics.

Two sites – Kilmorlie-McMillan and Verkaik – contain Onondaga chert projectile points with attributes from successive (contiguous) cultural traditions within the Archaic period (Table 4.4). These time-transgressive attributes suggest that specimens discarded in one period were reworked during the succeeding period. Alternatively, they suggest stylistic continuity between earlier and later forms. In either case, assuming attributes have chronological significance, these specimens indicate persistent use of these locations during the earlier

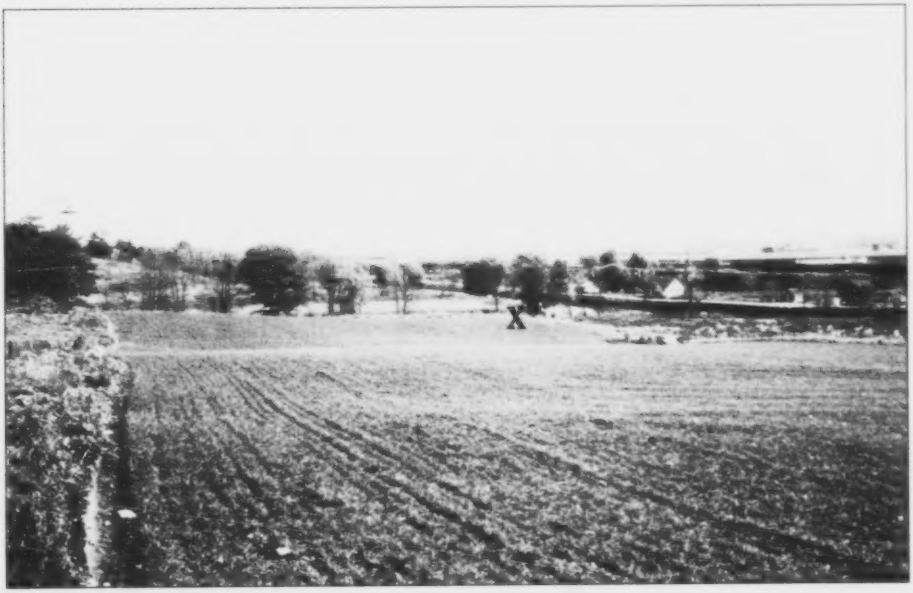


Figure 4.3 View of McMillan site, Looking Northeast Across the North Branch River (beyond field) into the Holland Marsh. (Photo taken by John Prideaux, 1978; 'x' marks find locations). With permission of the Royal Ontario Museum © ROM

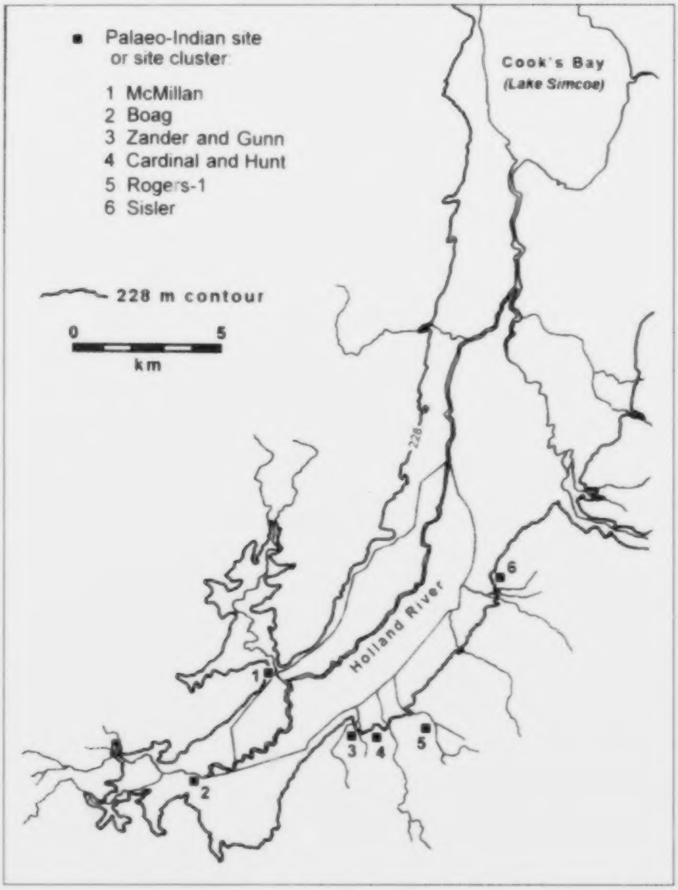

■ Palaeo-Indian site or site cluster
1 McMillan
2 Boag
3 Zander and Gunn
4 Cardinal and Hunt
5 Rogers-1
6 Sisler
228 m contour
0
5
km
Cook's Bay
(Lake Simcoe)
228
Holland River
1
2
3
4
5
6

Figure 4.4a Distribution of Palaeo-Indian Sites at about the 228 m Contour around the Holland Marsh.

part of the Archaic, with no major cultural hiatus. The Kilmorlie-McMillan site contains a nearly complete projectile point (Figure 4.11) that resembles Nettling type in its serrated blade edges and corner notching. This specimen also has a bifurcate base which is thinned and unground. It appears to represent a form that is transitional between Early Archaic corner-notched forms (Nettling) and slightly later bifurcate base forms. The Verkaik site contains another nearly complete specimen (Figure 4.12)–a large, stemmed point with prominent shoulders. This suggests an early Middle Archaic origin, but with slight bifurcate treatment of the base, which is suggestive of late Early Archaic forms, which have been dated to 8,500 to 8,000 B.P. in southern Ontario (Lennox 1993). Surface flaking is large and irregular but the point itself is well made, with few surface irregularities; one incurvate blade edge

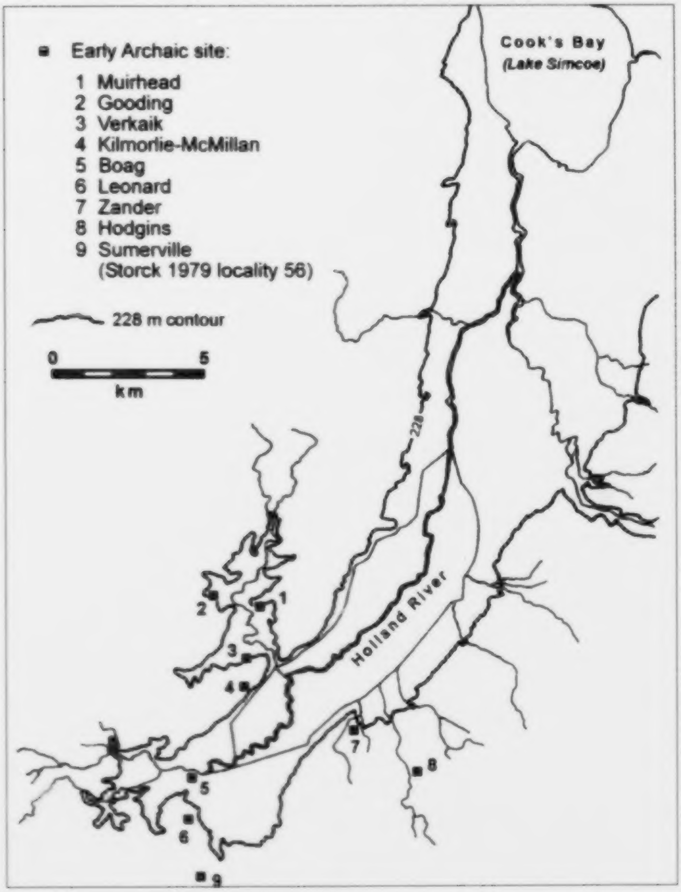

Early Archaic site:
1 Muirhead
2 Gooding
3 Verkaik
4 Kilmorlie-McMillan
5 Boag
6 Leonard
7 Zander
8 Hodgins
9 Sumerville
(Storck 1979 locality 56)
228 m contour
0
5
km
Cook's Bay
(Lake Simcoe)
228
Holland River
1
2
3
4
5
6
7
8
9

Figure 4.4b Distribution of Early Archaic Sites at about the 228 m Contour around the Holland Marsh.

suggests reworking. The Verkaik site appears on both Early and Middle Archaic site maps (Figures 4.4b, 4.4c).

Three other sites have Early Archaic projectile points as well as Middle or Late Archaic specimens, suggesting re-use of these locations at widely-separated times during the Archaic. The Gooding site contains the mid-section of a thin, well-made, notched specimen with serrations along both blade edges, probably a Nettling form (Figure 4.13). Another well-made, slightly serrated, corner-notched point, probably Nettling, is part of a private collection at a neighbouring farm (Plate 6 in Stewart 1982). The Gooding site also has a corner-notched specimen (ROM catalogue no. 982.134.1) with a flat, unground basal edge and thick cross-section, probably Middle Archaic (Brewerton) in origin. The Leonard site has

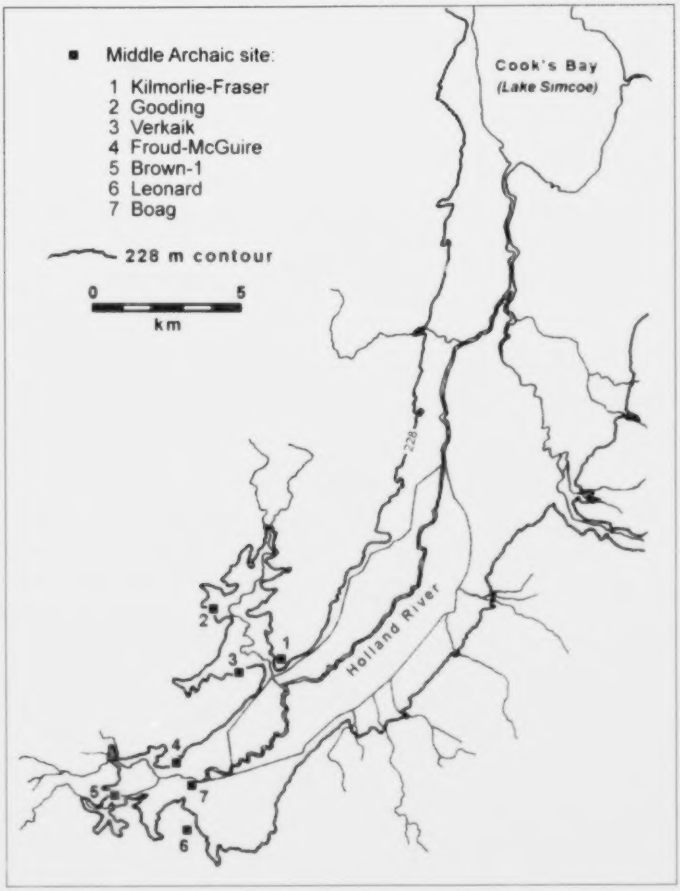

■ Middle Archaic site:
1 Kilmorlie-Fraser
2 Gooding
3 Verkaik
4 Froud-McGuire
5 Brown-1
6 Leonard
7 Boag
228 m contour
0
5
km
Cook's Bay
(Lake Simcoe)
228
Holland River
1
2
3
4
5
6
7

Figure 4.4c Distribution of Middle Archaic Sites at about the 228 m Contour around the Holland Marsh.

one Early Archaic, serrated, corner-notched form (Storck 1979, Plate 31d) and two possibly Middle Archaic side-notched forms (one of which is illustrated in Plate 31k in Storck 1979). At the Muirhead site, a thick, weakly side-notched point, basally thinned, is serrated along both edges of the distal half of the blade (Figure 4.14). These attributes are typical of both Early (side-notched and Nettling) and Middle (side-notched) Archaic forms (it appears as the former in Figure 4.4b). Another specimen from this site (Figure 4.14) is a large stemmed point (the base is broken) with a plano-convex cross-section. It is probably a Late Archaic Genesee type, falling within the range of variation in shape and thickness described for similar types at the Peace Bridge site on Lake Erie (Williamson and MacDonald 1997).

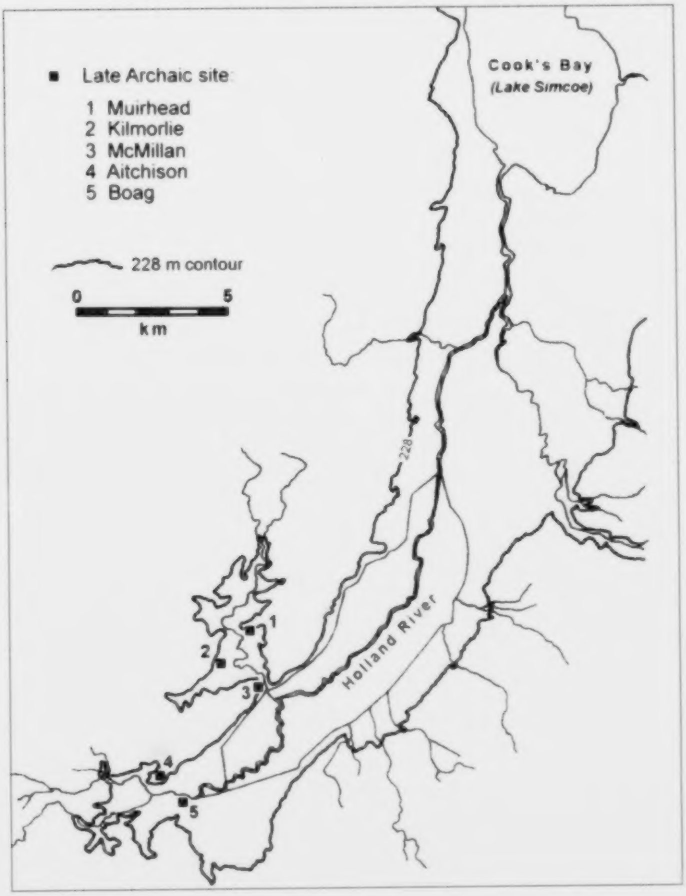

■ Late Archaic site
1 Muirhead
2 Kilmorlie
3 McMillan
4 Aitchison
5 Boag
228 m contour
0
5
km
Cook's Bay
(Lake Simcoe)
228
Holland River
1
2
3
4
5

Figure 4.4d Distribution of Late Archaic Sites at about the 228 m Contour around the Holland Marsh.

Discussion

Surveys around Holland Marsh in the 1970s and 1980s were an extension of the strategy of searching for Palaeo-Indian sites by focusing on the strandline of glacial Lake Algonquin/Ardtrea (Storck 1979, 1982). Two large Palaeo-Indian sites (Boag and Zander) and several smaller ones were found at that time (Figure 4.4a). In addition to this early cultural material, other sites with diagnostic material were located around the marsh and concentrated in three places (Figure 4.15 for sites and Figure 4.2 for place names). These places include the lower Kettleby Creek valley; the lower basin of the North Branch tributary; and along the upper West Branch, near the confluence of several tributary streams east of Schomberg. This

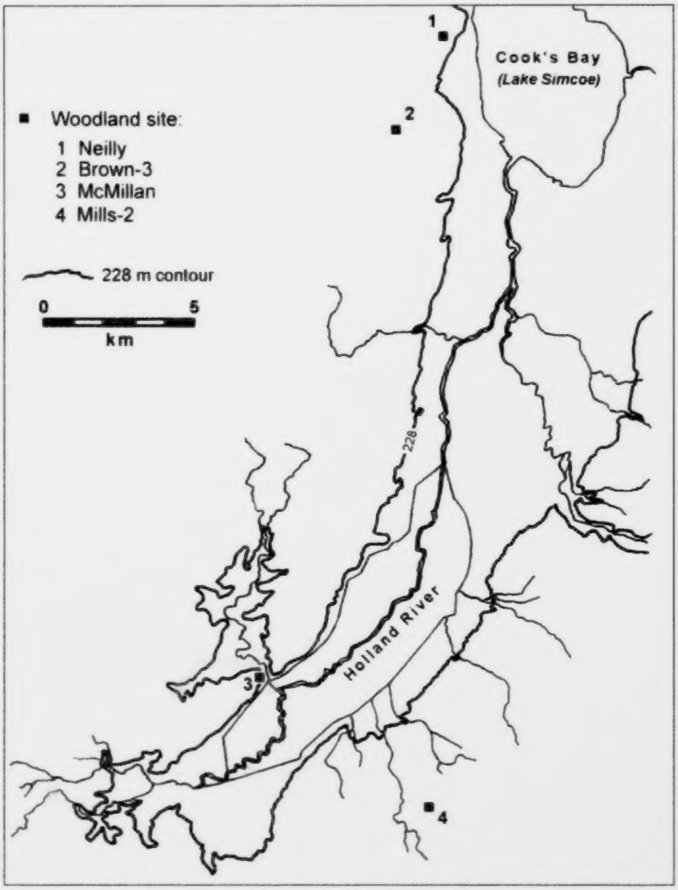

Cook's Bay
(Lake Simcoe)
■ Woodland site:
1 Neilly
2 Brown-3
3 McMillan
4 Mills-2
228 m contour
0
5
km
228
Holland River
1
2
3
4

Figure 4.4e Distribution of Woodland Sites at about the 228 m Contour around the Holland Marsh.

record of sites extending through the Holocene allows comparison of general patterns of settlement through time. One trend is a decrease in evidence for settlement around the marsh after the Middle, and especially after the Late, Archaic (Figure 4.4). Another is a shift in spatial distribution from concentrated Palaeo-Indian settlement at the end and on the south side of the embayment during early post-glacial times, to more diffuse Archaic settlement around the marsh during the Holocene. Prior to the Woodland period the multi-component nature of the earlier part of the record suggests more continuous use of sites during Palaeo-Indian and Early Archaic times (Table 4.3). Some implications of these patterns can be further explored.

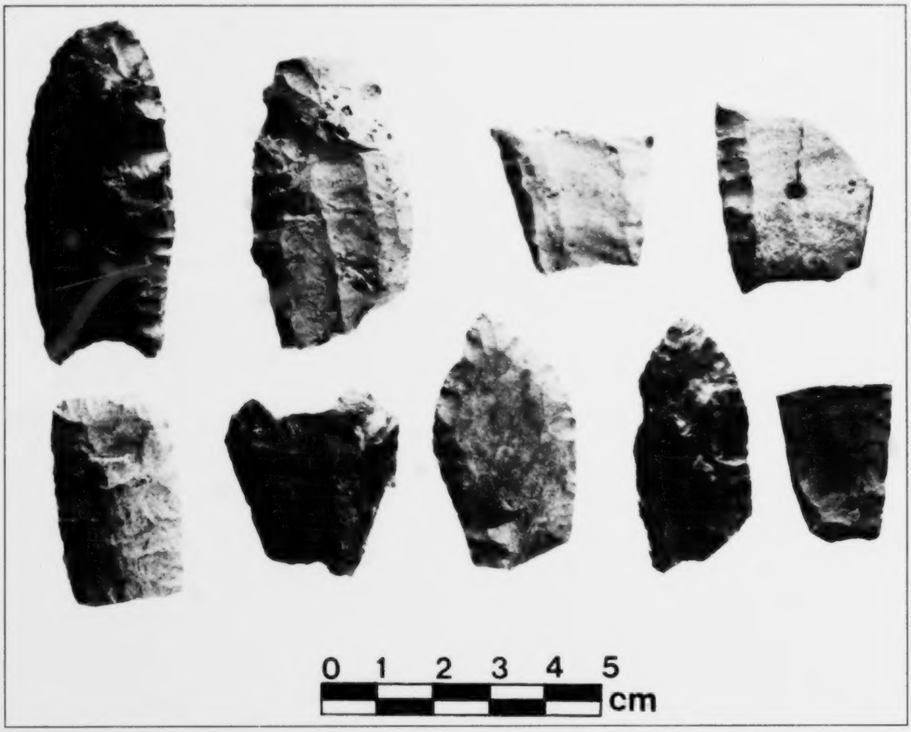


Figure 4.5 Projectile points collected privately from the Zander site include, from left to right, top row-Gainey fluted point, distal end of fluted preform, two Crowfield fluted point bases. Holcombe point distal fragment is second from right on bottom row. With permission of the Royal Ontario Museum © ROM.

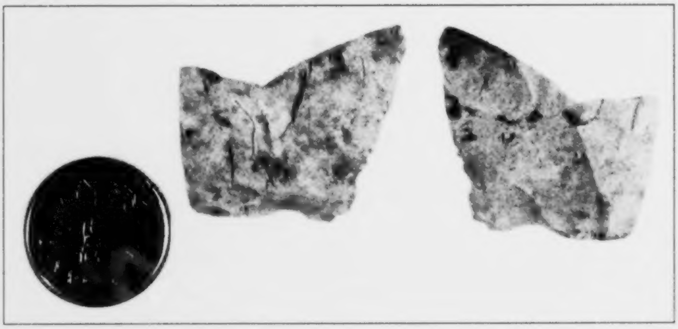


Figure 4.6 Thinned or fluted point base from the Boag site (ROM catalogue number 977.174.263).

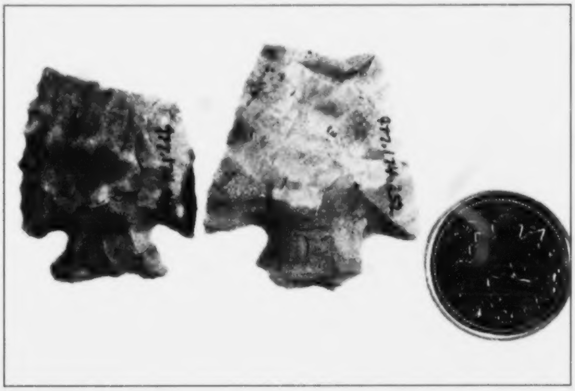


Figure 4.7 Two Early Archaic Corner-Notched Point Bases from the Boag Site (977.174.253 and 252).

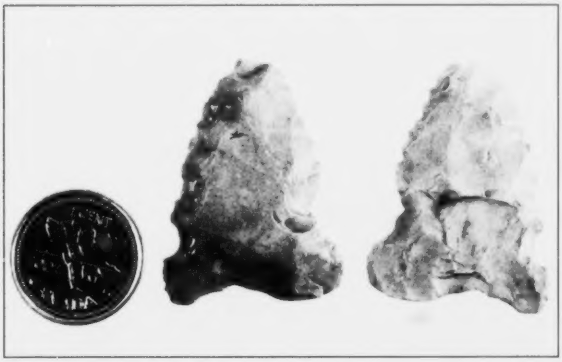


Figure 4.8 Side-Notched Point from the Boag Site with Both Early and Middle Archaic Attributes (979.305.10).

Focused Palaeo-Indian Settlement at Embayment Head

The glacial lake embayment represented by Holland Marsh is part of a larger convoluted fossil shoreline of eastern Lake Algonquin/Ardtrea, which is associated with a high proportion of the known Palaeo-Indian sites on this lake (Storck 1982). The distribution of sites from this period, including Early and Late Palaeo-Indian components (Figure 4.1), indicates a clustering of sites at the south end, or head, of the embayment. This spatial pattern suggests a preference not only for convoluted oversimple shorelines but also for areas of indented shorelines that are closer to embayment heads than to either embayment mouths or points of land. This bias can be related to settlement patterns of Palaeo-Indians, which may have been tied to the movement of migratory caribou along glacial lake shorelines (Jackson

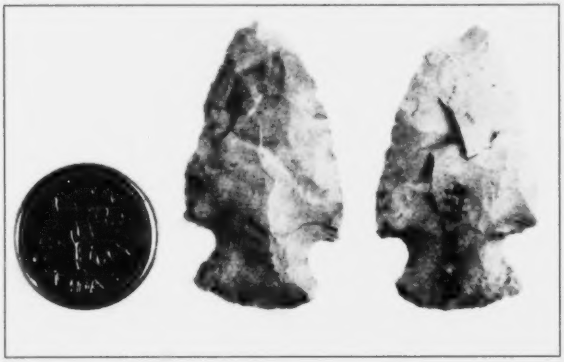


Figure 4.9 Late Archaic Notched or Expanding Stem Point from the Boag Site (979.305.251).

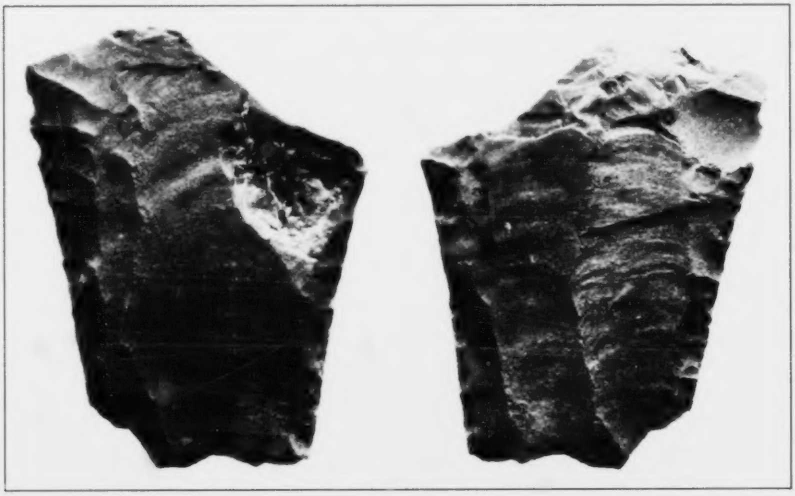


Figure 4.10 Crowfield Fluted Point from the Sisler Site; Length is 40 mm (982.122.8). With permission of the Royal Ontario Museum © ROM.

1997). An approach to understanding this spatial pattern can be made by looking at settlement patterns of recent Caribou Inuit hunters in Arctic Canada – one of several possible ethnographic analogies with northern hunting cultures for aspects of land-use or settlement patterning of late glacial foragers (Loring 1997).

In the Canadian Arctic, west of Hudson Bay, inland Inuit hunted caribou year-round on the tundra during most of the last two centuries (Burch 1972, 1986).

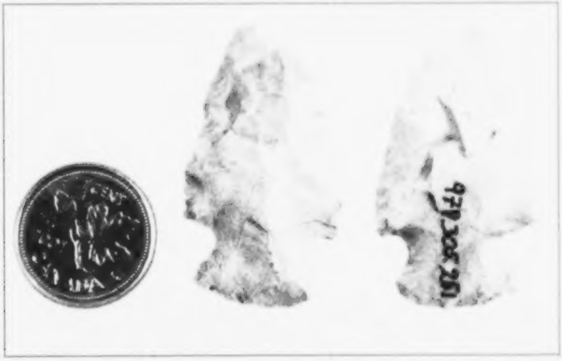


Figure 4.9 Late Archaic Notched or Expanding Stem Point from the Boag Site (979.305.251).

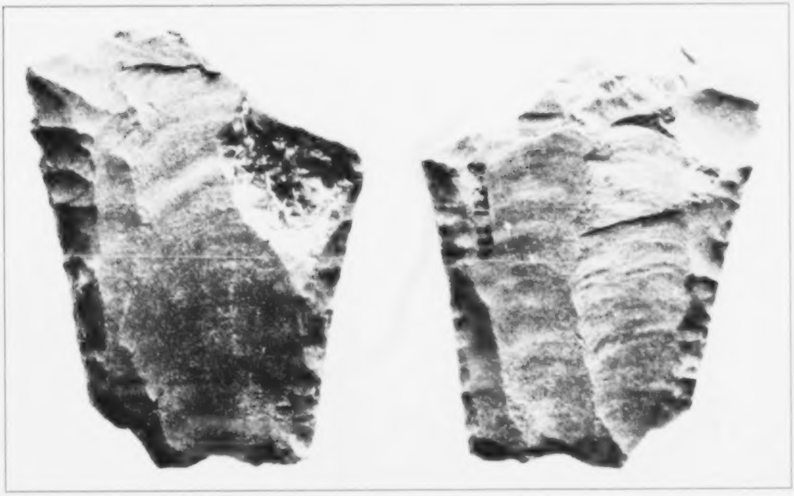


Figure 4.10 Crowfield Fluted Point from the Sisler Site: Length is 40 mm (982.122.8). With permission of the Royal Ontario Museum © ROM.

1997). An approach to understanding this spatial pattern can be made by looking at settlement patterns of recent Caribou Inuit hunters in Arctic Canada – one of several possible ethnographic analogies with northern hunting cultures for aspects of land-use or settlement patterning of late glacial foragers (Loring 1997).

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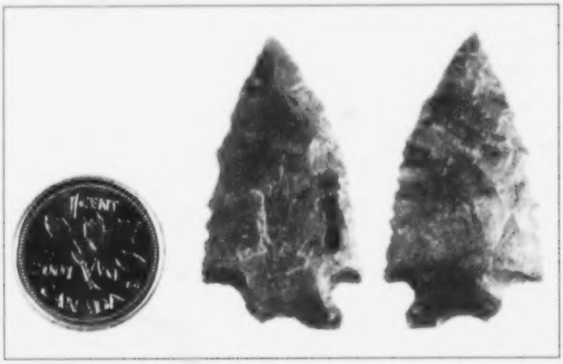

Figure 4.11 Early Archaic Serrated Point from Kilmorlie-MacMillan site (982.153.1).

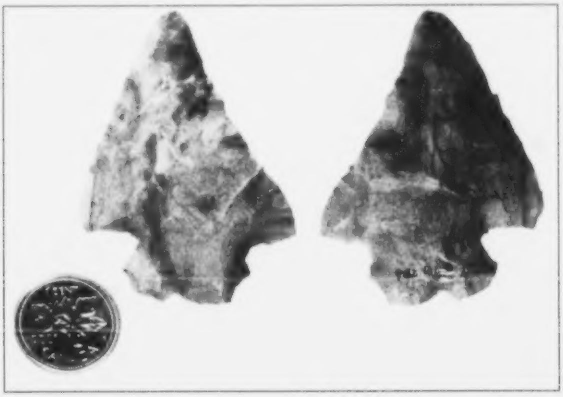

Figure 4.12 Early-Middle Archaic Stemmed Point from Verkaik (982.161.2).

Although late summer and fall hunting was critical for meat and skins for the winter, interception of north-migrating herds in spring was also important for obtaining and drying meat. Settlement at both times was concentrated along the south shores of lakes and rivers (Birket-Smith 1929:62–4; Rasmussen 1930:14–5). East-west trending reaches of the Kazan and Thelon rivers, in particular, represented useful barriers for slowing or channelling the movement of herds. In spring, these rivers served to slow spring migration during ice break-up: instead of crossing directly when they reached these bodies of water, caribou sometimes travelled along the south shore, waiting for the moving ice to clear. Spring hunting sites of Inuit who were living along the lower Kazan River are commonly found on these south shores near the heads of the embayments around which the caribou passed (Stewart *et al.* 2000). By contrast, late summer and fall camps tend to occur at other places along the south shore, often on points of land to which the caribou swam.

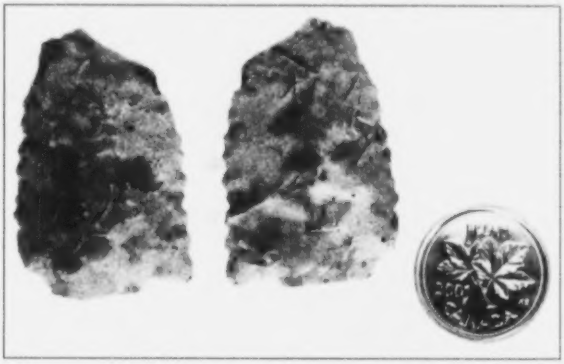

Figure 4.13 Early Archaic Serrated Point from Gooding (982.134.2).

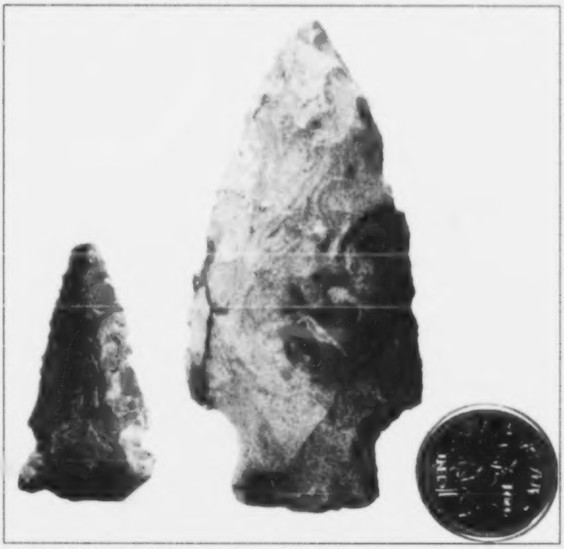

Figure 4.14 Side-notched Point with Early and Middle Archaic Attributes (left, 982.136.3) and Late Archaic Genesee Point (right, 982.136.4), Both from the Muirhead Site.

Migratory caribou may have been important to Palaeo-Indians living in relatively open environments in the Northeast and Great Lakes area during the early post-glacial period (Jackson 1997; Meltzer and Smith 1986). Evidence of raw material use around the lower Great Lakes supports arguments for long-distance movements of people (Simons 1997; Storck and

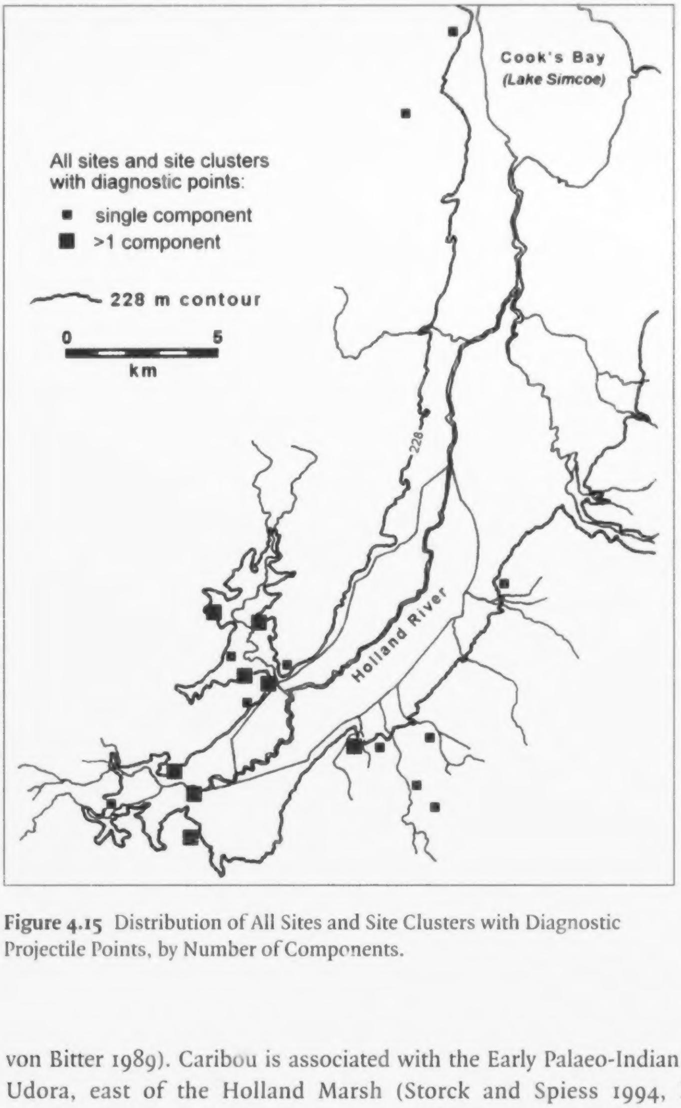
Cook's Bay
(Lake Simcoe)
All sites and site clusters with diagnostic points:
▪ single component
■ >1 component
228 m contour
0
5
km
228
Holland River

Figure 4.15 Distribution of All Sites and Site Clusters with Diagnostic Projectile Points, by Number of Components.

von Bitter 1989). Caribou is associated with the Early Palaeo-Indian (Gainey phase) site at Udora, east of the Holland Marsh (Storck and Spiess 1994, Figure 1). Along the Algonquin/Ardtrea shoreline in the Simcoe lowlands, north of the Oak Ridges moraine, an open forest-tundra environment may have persisted due to cold lake effects until 10,000 B.P., or later (Jackson 2000:435; Muller 1999; Storck 1997:273–4). Migratory caribou, who were travelling along this shoreline from southwest to northeast during the spring, could have been deflected by water and ice in the Holland Marsh and Minesing Swamp basins southwards around the heads of these embayments (Figure 4.1). Thus, spring settlement might have been clustered in these embayment-head areas. Heads of embayments were not an exclusive focus of Palaeo-Indian settlement, as the location of the Holcombe-complex

Fowler site indicates (Woodley 2000, Figure 1). Continuing the comparison with the Caribou Inuit on the Kazan River, the location of this site at the end of a large, northward-projecting peninsula between the Minesing and Holland Marsh basins would be more typical of a summer or fall camp location than a spring location. Like inland Inuit camps, it may have been situated on the south side of a major water barrier, allowing hunters to intercept swimming or landing caribou - in this case, from the island north of the channel which joins the Georgian Bay and Lake Simcoe lowlands (Figure 4.1). The higher concentration of sites at embayment heads like upper Holland Marsh and the Thedford embayment (Ellis and Deller 2000:251–2) suggests, accordingly, a bias in the settlement record towards spring occupations. If these concentrations are not simply the result of uneven survey coverage, reasons for this bias may include higher densities of people or activities in spring, and more visible (fewer perishable) remains associated with spring camps. Changes in types of shoreline features offer a relatively unexplored dimension of the palaeo-environment against which to measure variation in Palaeo-Indian settlement density and assemblage composition.

After the closing of the forest and the demise of migratory caribou, settlement around the Holland Marsh would be expected to change. The southern end of the marsh would no longer have provided a focus for the hunting of caribou. During the early Holocene, a broader range of wetland resources might have been exploited from other locations surrounding the marsh, as reflected in the Early Archaic site distribution (Figure 4.4b).

Early and Middle Holocene Land-Use

Comparison of sites around the Holland Marsh from different periods within the Archaic suggests that changes occurred in the size and patterning of these sites; although with only a small number of sites under consideration, any suggested trends are tentative. Such a comparison is worth attempting because of the long record of settlement around the marsh, during the Holocene. Moreover, the visibility of sites from the earlier part of the Archaic at the surveyed elevations should not be affected by inundation from mid-Holocene Lake Nipissing, a problem which has most likely resulted in underestimation of the extent of earlier Holocene settlement in Ontario (Ellis *et al.* 1990).

Site size, as measured by the frequency of artifacts per millennium from single-period (Early, Middle or Late Archaic) sites, increases through time from the Early to the Middle Archaic periods (Table 4.5); thus suggesting that middle Holocene sites were used more frequently, or for longer periods, than early Holocene sites. More recent (Late Archaic) sites are smaller. On the other hand, the evidence for Early Archaic settlement is more ubiquitous than that for the Middle Archaic: sites with components assignable to the Early Archaic are more common than sites with Middle Archaic components (Table 4.3). Thus, Early Archaic populations appear to have been widely scattered around the marsh (Figure 4.4b), occupying sites less frequently or less predictably than Middle Archaic populations, who may have used a smaller number of locations more consistently. This conclusion accords with findings of a study in southwest Indiana, in which the association of projectile points with streams of different size (orders) across a range of elevations indicates that settlement strategies differed for Early and Middle Archaic period populations (Stafford 1994). Specifically for the Early Archaic, Stafford infers wide-ranging foraging in uplands and lowlands involving frequent

Table 4.5 Artifact Frequencies at Archaic Sites that Contain Diagnostic Artifacts of only One Period. Bold font indicates results from more than one surface collection.

Period	Single-Period Site	Freq. of Projectile Points	Total Size of Collection	Total Size per 1000 yrs
Early Archaic	Hodgins	1	3	1.5
	Kilmorlie-McMillan	1	6	3.0
	Sumerville	1	3	1.5
Middle Archaic	Kilmorlie-Fraser	1	43	12.3
	Froud-McGuire	**3**	**57**	**16.3**
Late Archaic	Aitchison	2	4	2.4

residential movement across a landscape that was relatively undifferentiated in the distribution of its resources. For the Middle Archaic, evidence suggests that people were more logistical in their movements to obtain resources and that they were residentially based out of larger camps in the lower parts of valleys.

The data considered here is restricted to the edge of the Holland Marsh and thus cannot be used to test land-use change at different elevations or across drainage boundaries. Nevertheless, the idea that Middle Archaic settlement involved the use of more permanent base camps around wetlands, possibly with less residential mobility, is consistent with evidence for increasing site size and a more restricted distribution of site locations around the Holland Marsh between 8,000 and 4,500 B.P.

Landscape Evolution and Site Distribution

The spatial distribution of sites around the marsh, many of which occur on floodplains associated with lower tributary channels, may be affected by geomorphic changes in the landscape during the Holocene. On the southeast side of the marsh these channels tend to drain steep slopes, including the north-facing slopes of the Oak Ridges moraine. Colluvial and alluvial sediment, prograding as fans into these lower valleys during periods of reduced vegetation and increased precipitation, may have buried archaeological material. Alternatively, it may have been removed from higher locations within these tributary valleys, until the sediment finally came to rest in fans at the outlets (e.g., Bettis and Hajic 1995; Stafford *et al.* 1992). These processes would have the effect of hiding or distorting the preceding settlement record. For example, the Zander and nearby sites (3, 4 and 5 in Figure 4.4a) might have been influenced by geomorphic change that occurred after their emplacement within the Kettleby Creek basin. This tributary creek and its adjacent channels empty into an indented part of the strandline, which formerly defined a shallow embayment of the glacial lake. Here, the Palaeo-Indian sites occur at both lower and higher elevations within the tributary basin – the Zander and Cardinal sites are on or just above the strandline, whereas the Hunt and Rogers-1 sites occur higher up the basin on the shoulder of these steep-sided gullies or ravines. The relationship between the lower and higher sites is unclear beyond the fact that Early Palaeo-

Indian material is represented in both locations, but erosion of some of this material from the shoulders of the slope and re-deposition down-valley is a possibility. Like Zander, Palaeo-Indian material at both the Sisler and McMillan sites also occurs at the outlets of tributary channels.

In higher areas of this landscape, early material may be exposed at the shoulders of slopes while remaining deeply buried (below the plough zone) further back on summits. Downslope, at the edge of the marsh along the former shoreline, material may be redeposited and partly buried by alluvial and colluvial movement of sediment from gullies. In parts of the U.S. Midwest, much of this kind of fan development happened in the early and middle Holocene, by 4,000 B.P. (Wiant *et al.* 1983). Assuming the same geomorphic processes were operating in Ontario at the same time, such landscape re-working might cause researchers to underestimate the amount of settlement on uplands and to interpret patterning of cultural material at lower elevations solely in terms of cultural processes. Landscape evolution in southern Ontario during the Holocene, and its effect on site visibility and preservation, has yet to be systematically explored.

Conclusion

Surface finds of time-diagnostic projectile points suggest extensive occupation around the edges of the Schomberg embayment and Holland Marsh in the Simcoe lowlands of central southern Ontario by Palaeo-Indian and Archaic period peoples between about 11,000 and 3,000 B.P. This occupation appears to be coarsely structured through time and in space, although the effect of erosion, redeposition and burial on this patterning is unknown. The largest number of sites or components occurs during the period of greatest environmental change – the Early Archaic, followed by the Middle Archaic (Figure 4.4b and 4.4c). During this time, forest succession, fluctuating lake levels and Hypsithermal drying may have stressed human subsistence, causing settlement to concentrate around stable wetlands.

Most of the early (Palaeo-Indian) settlement occurs near the outlet of Kettleby Creek and along the southeast shore of the embayment. It also appears to be associated with the head of the embayment – a setting associated with spring settlement among inland Inuit who hunted caribou north of the treeline in central Canada during the last two centuries. During the Early Archaic, settlement re-locates further upstream on the Holland River (West Branch) and to the lower part of the North Branch and then, during the Middle Archaic, contracts to a smaller number of larger sites. Land-use around the marsh is maintained during the Late Archaic but appears reduced during the Woodland period. An exceptionally persistent place for settlement occurs within one km of the outlet of the North Branch (Figure 4.3), where all periods from Palaeo-Indian to Woodland, inclusive, are represented (Figures 4.4a to 4.4e). This part of the marsh continued to be important during the post-contact period: Great Sail, the Mississauga chief, had his camp here when he met Governor Simcoe's party in 1794 (Robinson 1965:190).

The marsh, like other wetlands in the northern temperate world (Coles 1998; Nicholas 1998b), likely provided a means of transportation and defence in addition to its role in subsistence. For example, the North Branch probably formed part of the route from the Carrying

Place trail at Lake Ontario, across the Holland Marsh, northwest into the Nottawasaga River, through the Minesing Swamp (Figure 4.1), and on to Georgian Bay on Lake Huron (Robinson 1965:206). Sites on higher ground within the marsh just east of Schomberg (Figure 4.2), may have been difficult to reach and defensible from travellers along this route while, at the same time, providing their residents access to the resources of the marsh.

Much of the evidence from surface surveys around the Holland Marsh relates to the Palaeo-Indian and Early Archaic periods (Table 4.3). The presence of finely-flaked, serrated corner-notched projectile points that resemble Nettling (Ellis *et al.* 1991), suggests that the range of this Early Archaic form in southern Ontario extends north to include the Simcoe lowlands (see Wright 1978; 1995:73), where they occur with Late Palaeo-Indian lanceolate forms. People settled around the marsh during the early Holocene. This was despite or, perhaps as a result of, rapidly fluctuating water levels in the Huron and Georgian Bay basins, following the recession of Lake Algonquin/Ardtrea between 10,500 and 10,000 and lasting until at least 7,500 B.P. (Lewis *et al.* 1994; Lewis and Anderson 1989). Today, evidence of this settlement indicates that the material cultural remains of early Holocene hunter-gatherers have not simply been inundated by the Great Lakes but rather, are preserved around major wetlands. This should serve to focus the search for early Holocene sites in the future.

Acknowledgements

I thank the Dept of Anthropology at the Royal Ontario Museum for access to artifact collections and notes for this research. All photographs are courtesy of the ROM. Dr. Ron Williamson drew my attention to the transitional forms of several of the Archaic period projectile points in these collections, and I thank him for his time and for our discussions about the significance of these forms. I followed John Prideaux into the Holland Marsh and Dr. Peter Storck of the ROM is responsible for getting us both there before the latest onslaught of urban sprawl and highway construction. This urbanization appears to be completing the job of the destruction of the 10,000-year old marsh that canalization began in the last century.

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5.

The Madina Phase: Late Pleistocene – Early Holocene Occupation Along the Margins of the Simcoe Lowlands in South-Central Ontario

Gordon C. Dibb

Abstract

Archaeological and palaeoecological data collected between 1975 and 1992 indicate occupations by Late Palaeo-Indian hunter-gatherer groups, along the margins of the Simcoe lowlands to the southeast of Cook Bay, Lake Simcoe, during the Late Pleistocene-Early Holocene transitional period. A base camp (Deavitt – 7Yk10) and 14 smaller hunting and/or maintenance encampments and isolated artifact recovery localities are described, and their cultural inventories analyzed. This data is compared with that recovered from similar Late Palaeo-Indian, contracting stemmed producing peoples, who succeeded the better-known Early Palaeo-Indian fluted point using groups, at the termination of the Pleistocene throughout most of Canada and the United States. The local environment is reconstructed for this poorly known period of Ontario's prehistory on the basis of pollen analysis at Rose Swamp near the Deavitt site, which is suggested to date to the period from shortly after the drainage of Lake Algonquin between 10,400 and 10,100 B.P.

Résumé

Les données archéologiques et paléoécologiques recueillies entre 1975 et 1992 indiquent que les chasseurs-cueilleurs du Paléoindien inférieur ont occupé le bord des basses terres de Simcoe au sud-est de la baie Cook, Lac Simcoe, à la fin du pléistocène et au début de l'holocène. On décrit un camp de base (Deavitt 7YK10) et 14 camps plus petits de chasse et/ou d'entretien et l'emplacement d'objets isolés; on analyse également leur matériel culturel. On compare ces données avec l'enregistrement de sites semblables qui, comprenant des pointes

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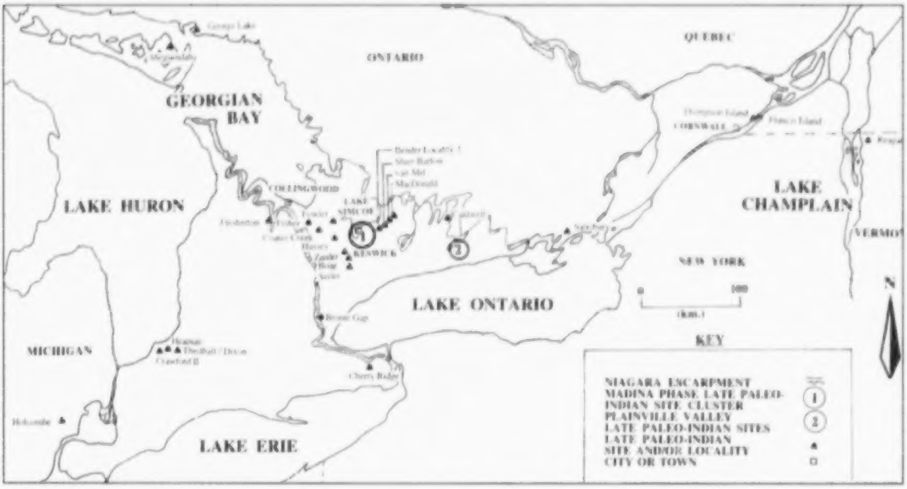
à pédoncule convergent du Paléoindien supérieur, étaient habités par des gens qui ont succédé aux groupes mieux connus, artisans des pointes cannelées, du Paléoindien inférieur à la fin du pléistocène. On a reconstitué l'environnement local correspondant à cette période méconnue de la préhistoire ontarienne en nous servant de l'analyse de pollens provenant de Rose Swamp situé près du site Deavitt qui, à mon avis, date de la période qui a suivi le drainage du lac Algonquin, entre 10 400 et 10 100 A.A.

Introduction

In recent years there has been an explosion of knowledge concerning the Palaeo-Indian occupation of Ontario. However, most of this research has focused on Early Palaeo-Indian assemblages, which tend to have the fluted point as their diagnostic markers, rather than on the subsequent Late Palaeo-Indian manifestations that tend to be characterized by lanceolate, contracting stemmed, unfluted forms. This paper attempts to correct this imbalance by reporting on a number of Late Palaeo-Indian assemblages recovered from the margins of the Simcoe lowlands in south central Ontario (Figures 5.1 and 5.2). A major focus of this document is to report on field investigations carried out at the Late Palaeo-Indian Deavitt site, and several other smaller locations that were likely more-or-less contemporaneous.

All the sites from the area, in addition to sites and find spots from other areas in southwestern Ontario, allow for the recognition and definition of distinctive Late Palaeo-Indian manifestations distinguished by lanceolate, contracting stemmed projectile points (hereafter referred to as contracting stemmed). The lithic tool kit is described, and through external


ONTARIO
QUEBEC
GEORGIAN BAY
LAKE HURON
COLLINGWOOD
LAKE SIMCOE
KESWICK
MacDonald
CORNWALL
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VERMO
NEW YORK
LAKE ONTARIO
MICHIGAN
Crawford II
LAKE ERIE
0
100
(km.)
N
KEY
NIAGARA ESCARPMENT
MADINA PHASE LATE PALEO-INDIAN SITE CLUSTER
1
PLAINVILLE VALLEY LATE PALEO-INDIAN SITES
2
LATE PALEO-INDIAN SITE AND/OR LOCALITY
CITY OR TOWN

Figure 5.1 Location of Late Palaeo-Indian Sites in Southern Ontario and Adjacent Areas in Michigan, Quebec and Vermont.

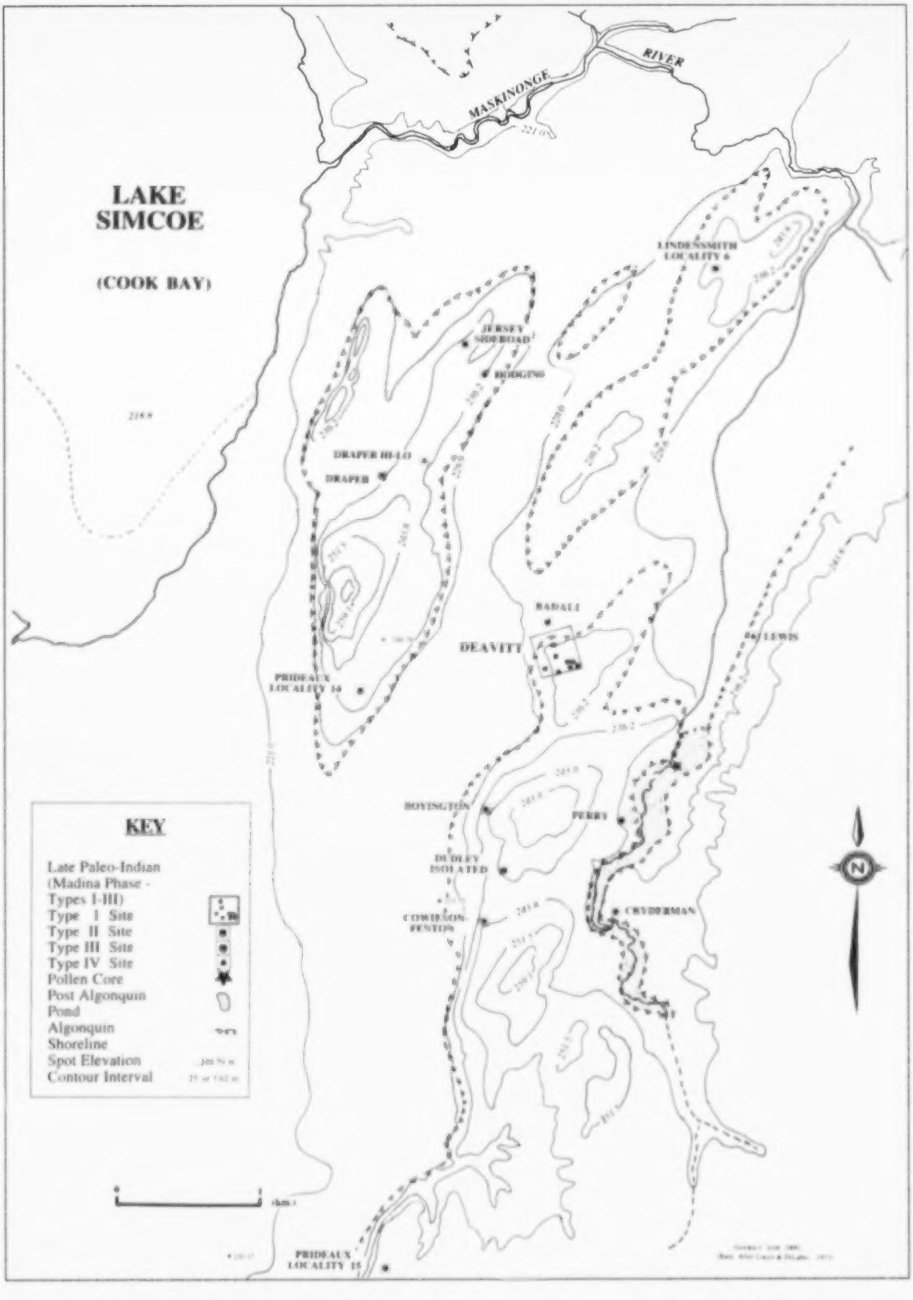

MASKINONGE
RIVER
LAKE SIMCOE
(COOK BAY)
LINDENSMITH LOCALITY 6
JERSEY SIDEROAD
HODGINS
DRAPER HI-LO
DRAPER
BADALI
DEAVITT
LEWIS
PRIDEAUX LOCALITY 14
BOYINGTON
PERRY
DUDLEY ISOLATED
COWIESON-FENTON
CRYDERMAN
PRIDEAUX LOCALITY 15
KEY
Late Paleo-Indian (Madina Phase - Types I-III)
Type I Site
Type II Site
Type III Site
Type IV Site
Pollen Core
Post Algonquin Pond
Algonquin Shoreline
Spot Elevation
Contour Interval
(km)

Figure 5.2 Location of Late Palaeo-Indian Sites in Relation to the Algonquin Strandline to the Southeast of Cook Bay, Lake Simcoe.

comparisons of the relationship of these finds to dated late glacial features, age estimates are provided. These age estimates, along with data from palynological studies carried out in the Simcoe lowland area, are used to suggest a palaeoenvironmental setting for Late Palaeo-Indian sites in this area, in addition to possible subsistence strategies.

Palaeo-Indian Research in Souhern Ontario

Palaeo-Indian research in southern Ontario shows that most of the archaeological data concerning Late Palaeo-Indian has been generated as a result of projects focusing upon the earlier Palaeo-Indian fluted point users. Since 1970 the main focus of this research has been:

(i) the shoreline of glacial Lake Algonquin and a series of early Holocene beach ridges along the margins of the Lake Simcoe-Georgian Bay basin (Deller 1976, 1979, 1980; Dibb 1979, 1980, 1982, 1985, 1991; Ellis 1989; Ellis and Deller 1983, 1990; Roosa and Deller 1982; Jackson 1977; Prideaux 1977, 1978; Stewart 1983, 1984; Storck 1978a, 1978b, 1978c, 1979a, 1979b, 1982, 1984, 1997),
(ii) the Lake Iroquois shoreline (Jackson 1997; Roberts 1982),
(iii) the Plainville valley (Jackson 1997),
(iv) the Niagara Escarpment (Storck 1973).

The Department of Anthropology at the University of Michigan did pioneer research on Palaeo-Indian in the Northeast, along raised beaches near Killarney, Ontario, between 1939 and 1953. At George Lake 1, Late Palaeo-Indian, Scottsbluff-like, lanceolate projectile points were recovered from isostatically uplifted beaches which have been geologically dated to about 8,000 to 9,000 B.P. (Greenman 1943, 1966; Greenman and Stanley 1943; Griffin 1983). In 1951, a National Museum of Canada survey project located another Palaeo-Indian component at Sheguiandah on Manitoulin Island, across the North Channel from the George Lake 1 site. Although Woodland materials were recorded from the upper stratigraphic levels of the Sheguiandah quartzite quarry site, Archaic and Late Palaeo Indian artifacts were found within the earlier levels (Lee 1952, 1957). This demonstrated presence of Palaeo-Indian in the Georgian Bay region, which became the starting point for what would become a multi-year, multi disciplinary research project conducted by the Department of New World Archaeology, at the Royal Ontario Museum (ROM).

In 1970 the ROM surveyed for Palaeo-Indian occupations along post-Algonquin shoreline features adjacent to the Sheguiandah-George Lake sites. A lack of exposed surface areas coupled with dense vegetation frustrated the research. ROM surveys from 1971 to 1973 concentrated along gaps, which were situated in the Niagara Escarpment. These gaps were of potential importance as hypothesized game trails for caribou. During this survey two isolated Late Palaeo-Indian lanceolate projectile points were found, along the upper escarpment at Flesherton and further south within the Bronte Creek gap (Storck 1972, 1973, 1982). Based on a report by Garrad (1971) that two fluted points had been found at a farm near Alliston, the ROM began investigations at the Banting site. The location of Banting upon a former Algonquin Island suggested that surveys along the Algonquin beach in the Simcoe Lowlands would be profitable. Between 1973 and 1975, ROM survey crews located small pre-ceramic encampments and three Palaeo-Indian sites with potential for excavation, along the Algonquin shoreline to the northwest and southeast of Alliston. In 1974, at the multicomponent Hussey site, Storck (1979a) recovered evidence of a small Late Palaeo-Indian encampment. The next year, the ROM conducted salvage excavations at the Late Palaeo-Indian and Early Archaic Coates Creek site, which was located along a post-Algonquin drainage feature tentatively identified with Lake Ardtrea (Storck 1978b). With the discovery of the Fisher site near Stayner in 1975, ROM research focused upon two central themes. These included the delineation of Early Palaeo-Indian settlement patterns, and the investigation into quarry and workshop sites near the bedrock exposures of Fossil Hill (Collingwood) chert - a lithic raw material frequently used by both Early and Late Palaeo-Indians in southcentral and southwestern Ontario (Storck 1982). Three non-fluted lanceolate projectile points (Storck 1997: Plate 3.9 f, g and h), were recovered from surface survey and at Fisher, thus documenting this area as having been visited on occasion by Late Palaeo-Indian related peoples. A 1979 ROM survey of the eastern margins of the Simcoe Lowlands located the Udora site, an Early Palaeo-Indian base camp, as well as several other hunting and/or maintenance-related encampments near the community of Udora. During this survey four possible Late Palaeo-Indian components were identified at the Bender Locality 3, MacDonald, Shier-Barlow and van Mil sites (Dibb 1979, 1982, 1983, 1985; Jackson 1979; Storck 1982, 1984).

In 1966 Brian Deller began surveying former glacial lake shorelines in southwestern Ontario for Palaeo-Indian sites. He discovered the major Crowfield, Parkhill and Thedford II sites. In addition, he found Late Palaeo-Indian artifacts at the Heaman and Tedball sites along the margins of the Thedford Embayment and at the Welke-Tonkonoh and Stewart sites along the Caradoc Sand Plain, near Mt. Brydges (Deller 1976, 1979, 1980; Deller, Ellis and Kenyon 1986; Ellis and Deller 1983, 1990).

In 1977 and 1978 John Prideaux surveyed the margins of a number of the finger-like embayments that characterize the south shoreline of Lake Algonquin. These embayments contain the contemporary Black, Maskinonge (Jersey), East Holland and Schomberg (West Holland) rivers which have their headwaters on the northern flank of the Oak Ridges moraine. Within the East Holland embayment, the Prideaux Locality 14 site yielded a small surface collection of Palaeo-Indian artifacts from a quarry along the edge of a former Algonquin island. In addition, a single flake of Fossil Hill chert was recovered from a promontory overlooking the main Algonquin beach ridge at Prideaux Locality 15. In the Schomberg embayment, Late Palaeo-Indian components were located at the Zander and Boag sites (Prideaux 1977, 1978). Further survey within this embayment in 1982, located the Sisler site, which includes a Late Palaeo-Indian component (Stewart 1984). At the Zander site test excavations in 1978 and 1982 indicated both Early and Late Palaeo-Indian occupations (Prideaux 1977, 1978; Stewart 1983, 1984).

Research projects have also been conducted near Rice Lake and along the north shore of Lake Ontario. Since 1977, Early Palaeo-Indian sites, such as Sandy Ridge and Halstead (Jackson 1998), as well as a series of isolated surface finds, have been found in a valley at the southwestern end of Rice Lake. This research produced a few lanceolate projectile points, which suggests that Late Palaeo-Indians were exploiting similar settings to those occupied by their fluted point manufacturing predecessors (Jackson 1984, 1997). In the late 1970's Arthur

Roberts surveyed portions of the glacial Lake Iroquois shoreline along the north shore of Lake Ontario. At the Salisbury site, located on a clay plain overlooking the Napanee River, a Late Palaeo-Indian contracting stemmed projectile point was found (Roberts 1982).

Three Late Palaeo-Indian sites and/or find spots, have been reported on the basis of CRM-related research: one site has been academically investigated, and one previously recorded site has been reinvestigated, since 1988. A contracting stemmed projectile point made of Balsam Lake chert was found at the Caldwell site near Peterborough (Dibb 1988). Rita Michaels (personal communication) found a Plainville-type, Late Palaeo-Indian projectile point at the Cherry Ridge site, near Ancaster, and Phil Woodley excavated two Holcombe-like transitional Early-Late Palaeo-Indian projectile points at the Fowler site along the Algonquin shoreline near Barrie (Woodley, this volume). The Caradoc site near Strathroy was test excavated in 1997 by Ellis and Deller. The artifact collection from this site includes Late Palaeo-Indian artifacts dating to the Late Holcombe and Hi Lo periods, between 10,400 to 10,000 B.P. (Deller and Ellis 1998). In 1990–1991, Sheguiandah on Manitoulin Island was reinvestigated in order to clear up problems associated with Lee's 1950s suggested dating of the site to ca. 30,000 B.P. Evidence now suggests that Sheguiandah was probably first inhabited by Late Palaeo-Indian (Eastern Plano) people about 9,500 B.P. (Julig *et al.* 1992).

Physical Landscape of the Study Area

The Simcoe Lowlands research described in this paper was initiated during an archaeological survey of streams that flow northward from the Oak Ridges moraine. The survey was conducted primarily along the terraces and flood plains of the East Holland and Maskinonge (Jersey) Rivers and their tributary streams. However, in an attempt to locate Early Palaeo-Indian sites (Dibb 1979, 1982, 1983, 1985), a limited section of shoreline associated with former Lake Algonquin, between the villages of Queensville and Keswick (named Madina in the mid-19th century), was included in the survey. No Early Palaeo-Indian sites were discovered, but contracting stemmed projectile points and bases, along with other tools and debitage that is diagnostic of a relatively little known phase of Late Palaeo-Indian culture, were found. To further define this phase, hereafter referred to as Madina, survey and monitoring activities were intermittently conducted from 1979–1992; and, in 1980 and 1982, test excavations were carried out at two loci of the Deavitt site, which was the largest of the sites belonging to this phase. The Madina phase probably dates to the period immediately following the main drainage episodes associated with glacial Lake Algonquin (Ardtrea), which would fall into the 10,400 to 10,100 B.P. time range.

The survey focused on four areas. The first was the Lake Algonquin shoreline, which overlooks the Simcoe Lowlands to the south-southeast of Cook Bay, as mapped by Gwyn and DiLabio (1973). The second area included three Algonquin islands (post-Algonquin uplands likely associated with Lake Ardtrea), which came into being soon after the ice dam broke at Kirkfield and allowed the drainage of glacial meltwater through the Trent-Severn system, which occurred about 10,400 B.P. (Dreimanis 1977; Karrow *et al.* 1975). The third focus was on selected sections of the upland till plains between the East Holland and Maskinonge river valleys. Finally, the fourth focus was on the margins of a post-Algonquin linear pond that,

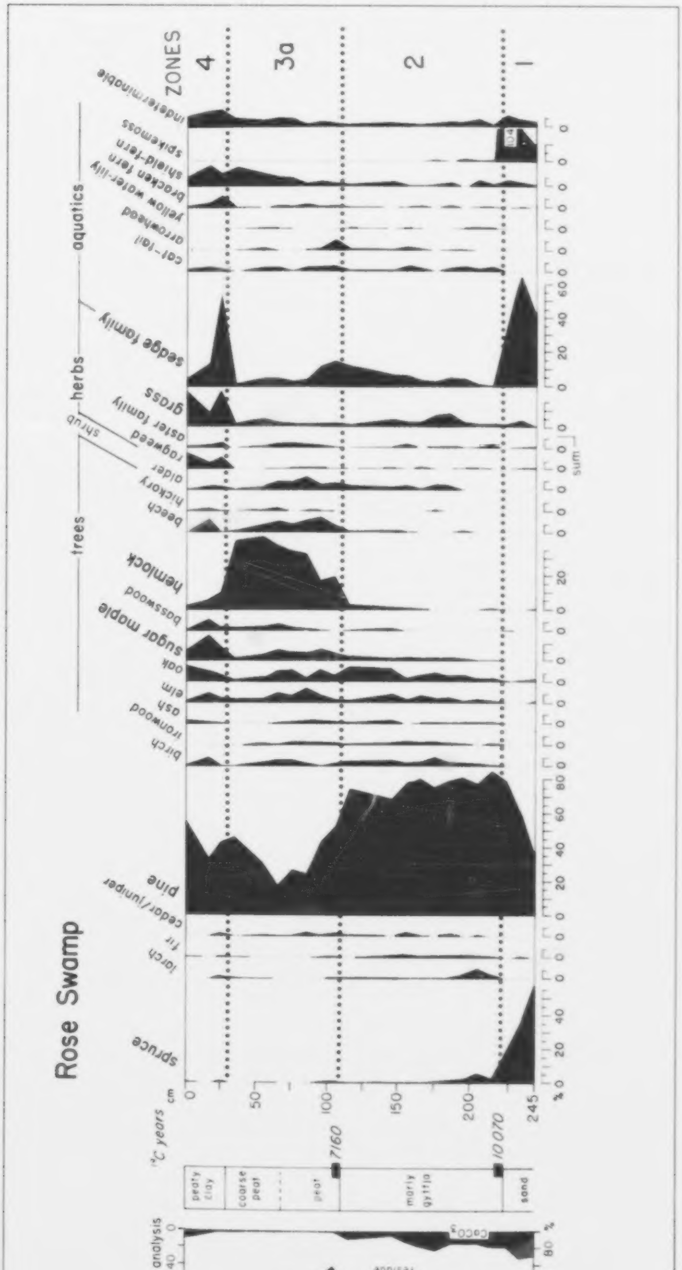
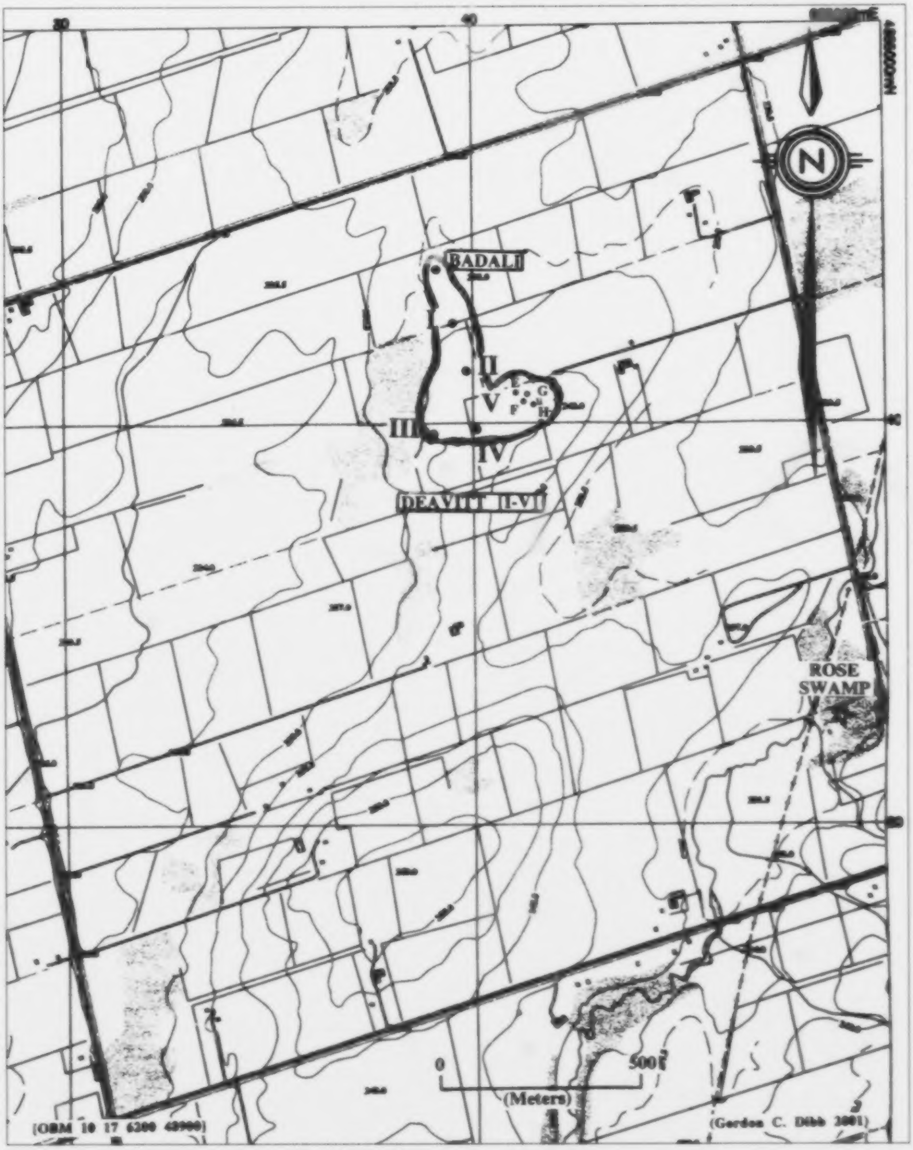


Figure 5.3 Pollen Diagram for Rose Swamp.


30
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DEAVITT I-VI
ROSE SWAMP
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(Meters)
[OBM 10 17 6200 48900]
(Gordon C. Dibb 2001)

Figure 5.4 Map Showing the Location of the Deavitt Late Palaeo-Indian (Including Badali) Site in Relation to the Rose Swamp Pollen Core (Contour Scale = 5 metres).

with the lowering of the main lake levels, persisted within the upper central section of the Maskinonge River valley for almost three millennia. Since the survey area is located within the Lake Simcoe-Kawartha Lakes drumlin field, most of the major shoreline features abut drumlins (Chapman and Putnam 1973). The elevations of the main Algonquin shoreline range from about 225 m asl. in the south to between 228 and 232 m asl. in the more isostatically uplifted sections at the north end of the study area.

The Deavitt site is located along the western side of an Algonquin peninsula that commands a panoramic overview of the Simcoe Lowlands to the southeast and southwest, and which today encompass the Maskinonge and East Holland rivers, respectively. To the north and northwest there are three former Algonquin islands. The peninsula was favoured because it would have been a natural crossing point for game, such as caribou, moving along the margins of the main shoreline to the adjacent upland features or between the two river valleys. At Deavitt, Areas II–V are situated at elevations of between 238 and 240 m asl., while Area I and the Badali site are located immediately below a secondary bluff, 300 m back of the main shoreline, at an elevation of about 235 m asl. Most of the other Late Palaeo-Indian sites and/or artifact find spots are situated either along or slightly above the main shoreline, at elevations ranging from 235 to 245 m asl.

Surveys to the north and northwest of the Deavitt site, covering almost 200 hectares of the Simcoe Lowlands (Algonquin lakebed), have not resulted in the discovery of components belonging to the Late Palaeo Indian period. The Deavitt site is located on a drumlin that is composed of Newmarket Till, which was deposited upon deglaciation about 13,100 to 12,300 B.P. (Gwyn and DiLabio 1973).

Palaeoecology

Paleoecology of the site was prepared by J. McAndrews. Today, the Deavitt site is located in the mixed forest zone, which is dominated by the conifer forests of white pine, hemlock and cedar, together with deciduous hardwoods such as sugar maple, beech, elm and oak. Northward, in central Ontario, jack pine and spruce replace white pine and these, combined with fir, birch, and poplar, form the boreal forest zone. Further north, spruce becomes the sole dominant in the forest-tundra transition to the tundra zone along the shores of Hudson Bay.

To make a local pollen diagram, Dr. J. McAndrews (Botany, ROM) cored the sediment of a former shallow embayment of Lake Algonquin called Rose Swamp, which is located along the modern Maskinonge River (Figures 5.3 and 5.4). Rose Swamp is a wetland that formed behind a Lake Algonquin beach bar and when the lake drained, it impeded drainage, which has been maintained by differential isostatic rebound, less in the south than in the north (the direction of river flow).

The pollen diagram displays the Late Pleistocene spruce zone 1 and Holocene zones 2, 3a and 4; subzones 3b, 3c and 3d are missing. The base of zone 2 was radiocarbon dated at 10,070 B.P. (WAT-1016), and the base of 3a was dated at 7,160 +/-100 B.P. (WAT-1017). The zone boundaries correspond with sediment change. The core was 250 cm long and had 27 cm of dense sand at the base that was successively overlain by marly gyttja, peat and peaty clay (Figure 5.3).

ZONE 1 is confined to the basal sand and is dominated by spruce and pine with abundant sedge and spikemoss, a boreal moss-like fern ally. The pollen density is low, ca. 1000 ml-1.

ZONE 2 is confined to the marly gyttja and is dominated by pine with small amounts of larch, fir, birch, elm, and oak, together with aquatics. Jack pine is abundant below 185 cm and white pine prevails above 185 cm.

ZONE 3 is confined to the peat and is dominated by hemlock and pine with significant beech. There is no hemlock minimum to define subzone 3b, and thus the peat is assigned to subzone 3a that terminated at ca. 5,000 B.P.

ZONE 4 is confined to the surface peaty clay and has abundant ragweed and other weed pollen, which accumulated due to European agriculture. Mollusks are abundant in the marly gyttja and absent from the peat. They are sparse in the basal sand and surface peaty clay. Plant macrofossils, especially seeds of aquatic plants, are unusually abundant.

The date of 10,070 +/-280 B.P. on the marly gyttja immediately above the basal sand shows the sand to be contemporary with Lake Algonquin. It represents a shallow-water delta deposit that was subject to wave action. With the drainage of Lake Algonquin, the landscape became forested, local wind velocities decreased, the climate warmed and a shallow, aquatic plant-filled pond came to occupy the former embayment. Concurrently, the zone 1 forest-tundra succeeded to the zone 2 boreal forest.

Jack pine, spruce and fir dominated the early boreal forest. With continued temperature rise, the white pine succeeded jack pine, and spruce all but disappeared. Beginning about 7,200 B.P. hemlock came to dominate the forest (subzone 3a). The pond had become filled with sediment and a marsh began depositing peat. Peat accumulation ceased perhaps 5,000 B.P. when the site became a cedar bog.

The zone 4 peaty clay represents local overbank levee deposits stemming from seasonal floods associated with forest clearance in the past century.

The Late Palaeo-Indian occupation of the Deavitt and surrounding sites and/or find spots, likely corresponds with the late pollen zone 1 – early zone 2 transition. If the Late Palaeo-Indian occupation were during late zone 1, the dominant vegetation would have been spruce and sedge, which compares with the modern forest-tundra. Using analogues with contemporary northern hunter-gatherers, major subsistence resources could have been barren ground caribou, hare and ptarmigan. If the occupation were during zone 2, the similarities would have been with a boreal forest setting. In the boreal forest, conifers, especially jack pine, were dominant; but white pine, spruce and fir were present with larch in the widespread wetlands (Simcoe Lowlands). Among the deciduous hardwoods were white birch, yellow birch and probably poplar. Nut bearing trees such as oak, were sparse or absent; although edible berries (e.g. blueberries) were likely abundant. In this boreal forest environment subsistence resources were probably woodland caribou, moose, beaver, hare and fish.

Modern hunters of the boreal forest usually put their base camps along navigable streams and not on a forested hilltop like the Deavitt site location. If the time of occupation was during late zone 1, the landscape would have been nearly treeless, and the hilltop base camp could have served as a lookout for migrating game such as barren ground caribou.

Late Palaeo-Indian Sites

Four types of Late Palaeo-Indian sites are illustrated in Figure 5.2. Types I–III are likely Madina phase in origin. The Type IV sites have Late Palaeo-Indian affiliations but are not related to the Madina phase.

The TYPE 1 site is a large strategically located base camp situated along a peninsula overlooking the Simcoe Lowlands. The Deavitt (7Yk10) site consists of 5 major locations that are likely each composed of 3 to 5 smaller units that may represent the former locations of tent and/or hearth type encampment units and/or specialized exterior activity areas. The Badali (BbGu-25) site is possibly an encampment associated with the Deavitt site along the northern margins of the same peninsula.

TYPE 2 sites are encampments where both tools and debitage were found. Sites in this category include; Draper (7Yk7; BbGu-6), Prideaux Locality 14, Boyington (7Yk11) and Cowieson-Fenton (7Yk3).

TYPE 3 sites are sites and/or find spots where single artifacts or pieces of debitage were found, which might indicate the presence of Late Palaeo-Indian sites (in the instances of Cryderman and Perry the sites appear to be multi-component). The lithics associated with the find spots, belong to either Raw Material Groups 1 or 2 (Balsam Lake or Fossil Hill) cherts and are considered "diagnostic and/or fossil" raw material types used by Late Palaeo-Indian groups locally. The sites in this category include; Cryderman (7Yk37), Perry (BbGu-11), Dudley Isolated (7Yk36), Hodgins (BbGu-18), Jersey Sideroad (BbGu-4), Lindensmith Locality 6 (BbGu-8) and Prideaux Locality 15. The Jersey Sideroad (BbGu-4) site includes 2 cores and 1 flake while the other sites in this category consist only of isolated flakes and/or debitage fragments.

TYPE 4 sites are either findspots and/or small encampments belonging to non-Madina phase visitors to the study area during the Late Palaeo-Indian period. The two sites in this category are Lewis (BbGu-4) and Draper Hi-Lo (BbGu-21). The pentagonal quartz projectile point from the Lewis site is similar in style to artifacts from the Late Palaeo-Indian Plenge site in New Jersey (Kraft 1973), and the Draper Hi-Lo site has produced a Hi-Lo type projectile point similar to ones found in southwestern Ontario (Ellis and Deller 1982).

Artifact Numbering

The artifacts described are from three collections. In this discussion artifacts are identified as coming from:

(i) Trent University – Deavitt (7Yk10);
(ii) ROM – Cowieson-Fenton 977.174.50,
(iii) York North Archaeological Services – Draper (BbGu-6).

Survey methodologies followed in each of these studies are summarized in Dibb (1985).

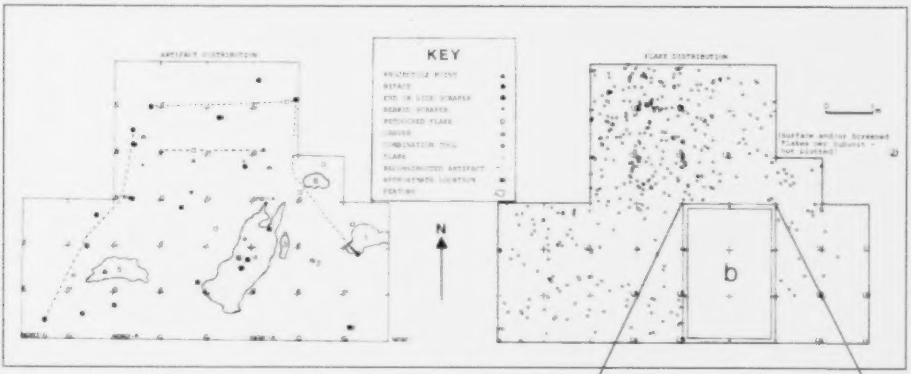
ARTIFACT DISTRIBUTION
KEY
PROJECTILE POINT
BIFACE
END OR SIDE SCRAPER
BEAKED SCRAPER
RETOUCHED FLAKE
GRAVER
COMBINATION TOOL
FLAKE
RECONSTRUCTED ARTIFACT
APPROXIMATE LOCATION
FEATURE
N
FLAKE DISTRIBUTION
b

Figure 5.5a

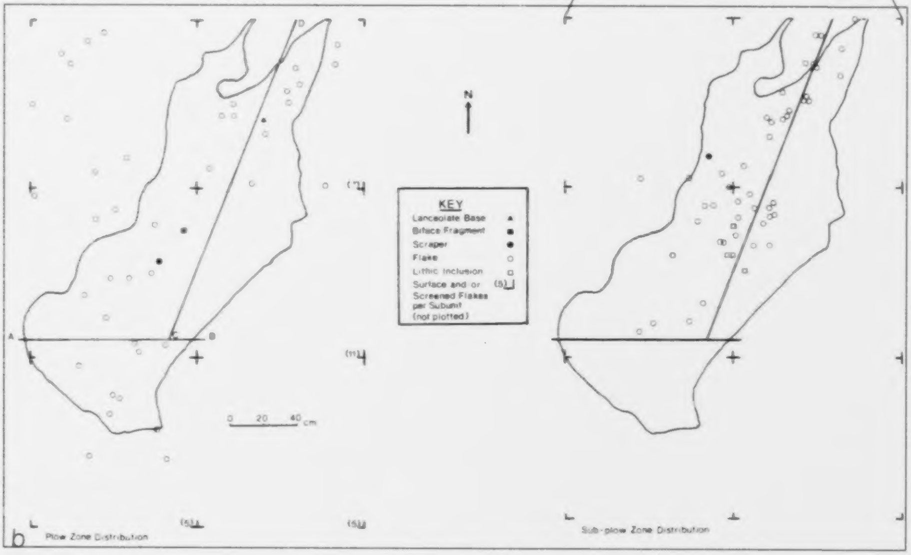
N
KEY
Lanceolate Base ▲
Biface Fragment ■
Scraper ●
Flake ○
Lithic Inclusion □
Surface and or Screened Flakes per Subunit (not plotted) (5)
A
B
C
D
0 20 40 cm
(11)
(5)
b
Plow Zone Distribution
Sub-plow Zone Distribution

Figure 5.5b.

Figure 5.5 Excavation Area E at the Deavitt Late Palaeo-Indian Site (top- a.) Showing Plan View (middle - b.) and Profile (bottom - c.) of Feature 4. (continued on page 129)

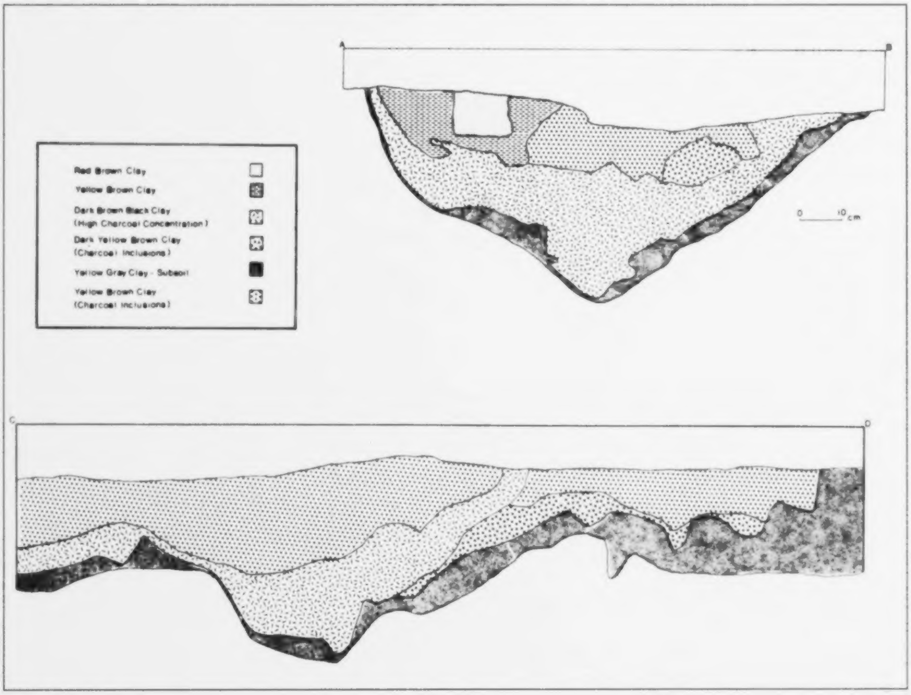
A
B
Red Brown Clay
Yellow Brown Clay
Dark Brown Black Clay
(High Charcoal Concentration)
Dark Yellow Brown Clay
(Charcoal Inclusions)
Yellow Gray Clay - Subsoil
Yellow Brown Clay
(Charcoal Inclusions)
0
10 cm
C
D

Figure 5.5c.

Excavations in Area V at the Deavitt (7YK10) Site

Excavations were carried out in 1980 and 1982, in Locus E and H, respectively. Based on detailed surface mapping, the two blocks of excavation units were located near the presumed centre of the respective clusters. The two excavation loci were recorded in relation to two metal data rods located in opposite fence rows within the northeastern corner of the field. The excavation units were 3 x 3-meter squares, which were subdivided into nine 1-meter units. Figure 5.5 shows the artifact and flake distributions from surface and excavated samples within Locus E.

Excavations totalled 80.5 m, 37 m from Locus E, and 43.5 m from Locus H. In Locus E excavation began with the shovel excavation of each 1-m subunit to a depth of 20 cm followed by trowelling to the subsoil. The soil from the plow zone was passed through 6.0-mm hardware screen. Subunits a, b, c and g of NoW1, in Locus E, were screened before it was realized that the soil was too clayey to properly process through this size screen. Screening was replaced by trowelling when it was seen that the artifacts were mostly small resharpening flakes and other forms of micro-debitage that readily passed through this size of mesh. The rest of the excavations in this locus (a further 33 meters) and all of Locus H were done from the field surface, with trowels, until subsoil was reached, generally at 20 to 25 cm depth. All artifacts were mapped based on their 3-dimensional placement within the plow zone.

Feature Excavations

The subsoil zones at Locus E had six features. Features 1, 2, 3, 5 and 6 were stains or debris from historic landscape alteration, such as the remnants of a temporary rail fence (a section of cedar rail and post mould comprising Features 1 and 2, respectively), and there was evidence of tree and/or brush removal.

Only Feature 4 contained abundant Late Palaeo-Indian artifacts. This feature had an amorphous plan view and extended into portions of 8 subunits (NoW1-A, B and C; NoW2-D, E, G, H and I). It was oriented to the northeast-southwest and was 1.16 m long. The southwestern end was bulbous and the northeastern end was bipointed (Figure 5.5a and 5.5b).

The feature was cross-sectioned along two transects, A–B oriented from west to east, and C-D oriented along a northeast-southwest axis. The A–B transect cutting across the south end of the feature exposed a large pit 109 cm across with a maximum depth of 48 cm. There were no artifacts in this pit but a 1.0-kg soil sample was retained for flotation. The C–D transect extended 84 cm east of the western edge of NoW2-H along the A–B transect line, and extended to the northeast to a point 59 cm east of the northwestern corner of NoW1-C. The total length of the C–D transect was 205 cm. Along the C–D transect subsections II and III delineated separate pits. Section II delineated the boundaries of a pit, 41 cm in depth, which contained 44 specimens of lithic debris (40 chert), plus a quantity of micro debitage that was recovered during flotation. Section III was at the northeast end of the C–D transect and was characterized by an undulating basal topography, The sub-plow zone cultural debris was not recovered from as tight a cluster in this section as in Section II (Figure 5.5b and 5.5c).

Botanical remains from the three pits in Feature 4 included 1 Chenopodium, 1 Geum, 9 Setaria, four unidentified seeds, and 60 spore balls. Of the .348 g of charcoal recovered, .305 g was from Pit II. All of the charcoal came from conifers. One 0.045-g piece was identified as cf. Picea or Larix. Conifer charcoal from Pit III was C14 dated to 4,330/ 350 B.P. (A.A.-360). Unfortunately soil samples from this feature were collected from arbitrary levels rather than by stratigraphic units. In conclusion, it is felt that the feature is a tree and/or root stain that overlies a Late Palaeo-Indian hearth or pit, which is preserved in Pit II. The major problem associated with dating the remaining charcoal samples from any of the three pits is the difficulty related to the separation of modern carbon (4,330 BP or more recent) from carbon of potentially greater antiquity. Of the dozen or so small charcoal flecks remaining from the combined samples, accelerator dating is both prohibitively expensive and difficult to entirely justify because of the possibility of inclusive modern carbon.

Four features were recorded from Locus H in 1992. Feature 1, in S1W2 was oval in plan view and 31 cm deep, filled with silty sand and one rock. Fossil seeds floated from this feature include 5 Cornus, 1 Rubus and 1 unknown. This feature was probably an historic post mould. Features 2 and 4 were plow stains and Feature 3 was a root stain. All 4 features in Locus H lacked artifacts.

Raw Material

The cultural artifacts from the Late Palaeo-Indian components in the Queensville-Keswick area are described in both diagnostic and debitage categories. Examples from the individual artifact classes within the major diagnostic categories are illustrated in Figures 5.7 to 5.15. Of the 1758 artifacts recovered from the survey and excavation (this includes Prideaux's 1977 and 1978 samples) over 99% are chert; one was quartzite, three were quartz and two were made from a coarse-grained black basalt like stone. Most of the raw materials were identified by comparison with "index" samples held by the Department of Invertebrate Palaeontology, ROM. In instances where "index" samples were unavailable for comparison, Eley and von Bitter assisted with specimen descriptions. The 14 Types of lithic raw material are described below. Table 5.1 shows the cumulative composition of the lithic raw materials utilized in this study.

TYPE 1, the most common chert, is dark blue-grey, often with a waxy to dull, earthy lustre. Weathering rinds, which form adjacent to the carbonate host rock, are light yellowish-brown. Depending upon the methods of trimming employed in the manufacture of the artifact, large areas of this rind are often incorporated with the specimen. This chert has a coarse peloidal texture and a hand lens reveals dark peloids, which are cemented together with lighter coloured quartz. Fossils in this chert include echnioderm fragments, corals and brachiopods. Bedrock exposures of Balsam Lake chert occur at Indian Point and Grand Island at Balsam Lake. Nodules have been found along the water's edge in Lake Katchewanooka, north of Lakefield. Stratigraphically, Balsam Lake chert belongs to the basal member of the Middle Bobcaygeon Formation, which overlies the Gull River (Trent River) Formation (von Bitter and Eley 1984; Eley and von Bitter 1985, 1989).

TYPE 2 is a creamy white chert that is often speckled, or occasionally banded. The speckles are a result of weathering of mineral impurities such as carbonates, clay, or iron that form surface or red stained pits when they are dissolved. Cherts are from outcrops of the Silurian Fossil Hill Formation, near Collingwood (Storck and von Bitter 1981). Others refer to the Fossil Hill chert as either Amabel chert (Deller 1976; Sheppard 1977) or Collingwood chert (Roosa and Deller 1982; Storck and von Bitter 1981).

TYPE 3 chert grades from jet black to light brown in color, and it is not unusual to find both colors within the same artifact. It is often glossy and has a medium to soft texture. The bedrock source is probably the Upper Gull River Formation, which has been found in situ near Cassidy Bay and Bryson Bay on Clear Lake, and near Warsaw, Ontario (Eley and von Bitter 1989).

TYPE 4 chert is a dark gray to mottled blue-grey colour with a relatively hard texture. At least two specimens from Deavitt (7Yk10.60 and .125) have been fire spalled. Several Deavitt specimens are from isolated contexts and may not be Late Palaeo-Indian. The specimen recovered at the Perry site may be from a lesser-known later component from this site. Similar Onondaga Formation cherts have been recovered at the Early and Late Palaeo-Indian Zander site (Stewart 1984). Onondaga cherts were quarried thoughout Ontario's prehistory from the Devonian outcrops along the north shore of Lake Erie.

Table 5.1 Diagnostic and Debitage Lithic Raw Material Recovered from Late Palaeo-Indian Archaeological Sites and/or Localities in the Keswick Study Area.

	Raw Material Group														
Name of Site	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Total**
Deavitt (7Yk10)															
Area I *(Diagnostic)*	2	12	11	2	6	0	0	0	0	2	0	0	0	0	35
(Debitage)	5	21	12	1	11	0	0	0	0	2	0	0	0	6	58
Area II	0	12	1	0	0	0	0	0	0	0	0	0	0	0	13
	0	22	0	0	0	0	0	0	0	0	0	0	0	0	22
Area III	4	7	2	0	0	0	0	0	0	0	0	0	0	0	13
	13	20	2	0	0	0	0	0	0	0	0	0	0	0	35
Area IV	0	2	6	0	0	0	0	0	0	0	0	0	0	0	8
	3	9	7	0	0	0	0	0	0	0	0	0	0	6	25
Area V	27	22	1	0	0	0	0	0	0	0	0	0	0	0	50
(Locus E)	497	183	6	3	3	0	0	0	0	0	0	0	0	15	707
Area V	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
(Locus F)	23	7	0	0	0	0	0	0	0	0	0	0	0	0	30
Area V	7	7	1	0	0	0	0	0	0	0	0	0	0	0	15
(Locus G)	45	30	1	0	0	0	0	0	0	0	0	0	0	0	76
Area V	17	18	2	0	0	0	2	3	0	0	0	0	0	2	44
(Locus H)	240	153	38	3	0	0	0	0	0	0	0	0	0	19	453
Isolated	0	0	0	3	0	0	0	0	0	0	1	0	0	0	4
	1	4	0	1	0	0	0	0	0	0	0	0	0	0	6
Cowieson-Fenton	1	14	0	0	0	0	0	0	0	0	1	0	0	0	16
(7Yk3)	0	24	0	0	0	0	0	0	1	0	0	0	0	0	25
Draper (7Yk7)	0	10	3	1	0	2	0	0	0	0	0	2	0	0	9
	3	13	1	0	1	0	0	0	0	1	0	0	0	3	22
Boyington (7Yk11)	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2
	0	2	0	0	1	0	0	0	0	0	0	0	0	1	4

continued...

Raw Material Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Cryderman (7Yk37)	0	1	0	0	0	0	0	0	0	0	2	0	0	0	3
	1	1	0	1	1	0	0	0	0	0	0	0	0	1	5
Perry (7Yk12)	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4
	0	7	0	0	0	0	0	0	0	0	0	0	0	1	8
Prideaux Locality 14	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Draper Hi-Lo (7Yk41)	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dudley Isolated (7Yk36)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Badali (BaGu-25)	0	3	0	7	0	0	0	0	0	0	0	0	0	1	11
	4	0	3	19	0	0	0	0	0	1	0	0	0	3	29
Hodgins (7Yk38)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Jersey Sideroad (7Yk4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Lewis (7Yk4)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lindensmith Loc. 6 (7Yk9)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Prideaux Locality 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	895	613	101	45	23	4	2	3	1	5	5	2	1	58	1758
%	50.9	34.9	5.7	2.6	1.3	0.2	0.11	0.17	0.06	0.28	0.28	0.11	0.06	3.3	99.97

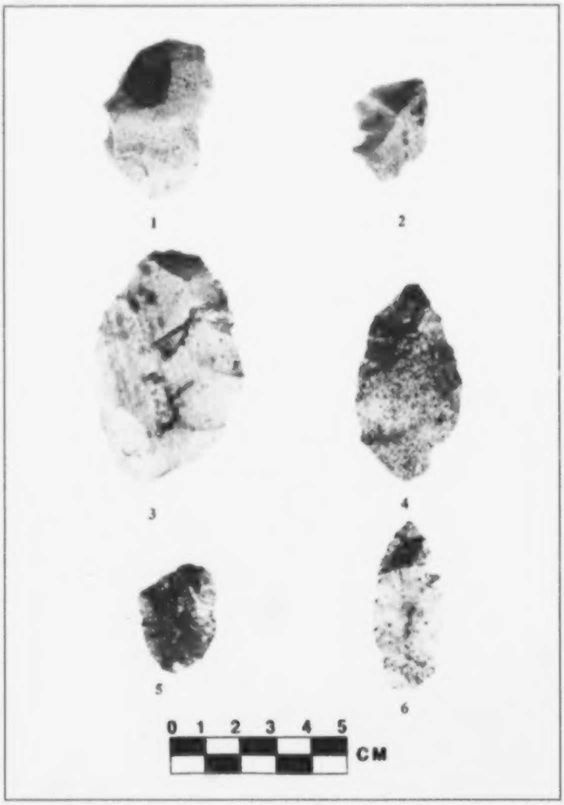

Figure 5.6 Preforms from the Deavitt and Draper Sites.

TYPE 5 cherts are light gray to creamy gray-white and are often translucent or semitranslucent; one variant is banded. It is very fine grained with a soft texture. Bedrock sources are probably located in the Upper Gull River Formation and these weather whitish, according to Eley and von Bitter (1989). The in situ sources are likely the same as Group 3 cherts.

TYPE 6 is a light blue-gray to mauve and relatively soft. Specimens have been recovered from the Draper and Draper Hi-Lo sites. This Kettle Point chert outcrops near Ipperwash along the southeast shore of Lake Huron (B. Eley, personal communication, 1985; Janusus 1984).

TYPE 7 is a buff to greenish-gray chert with black banding and a medium texture. This exotic is probably derived from bedrock outcrops either along the Canada-United States border or to the south of the St. Lawrence Lowlands along the shore of Lake Champlain. Macroscopic comparisons of samples suggest similarities with chert from the Reagan site in northwestern Vermont (Ritchie 1953, 1957). There is a single specimen of this chert from the Hussey site.

TYPE 8 is a medium gray exotic chert with distinctive white inclusions that sometimes led to breakage of artifacts during fabrication. It was recovered from Areas I and V (Locus H) at Deavitt and there is also a single specimen from the Hussey site. The source of this chert is unknown.

TYPE 9 is represented by a single orange-brown specimen with a medium texture from the Cowieson-Fenton site. This may be a chert or a chalcedony.

TYPE 10 is represented by 4 specimens from Loci I at Deavitt and a single specimen from Draper. This chert is light to medium gray in color and has a soft texture. 7Yk10.32 retains

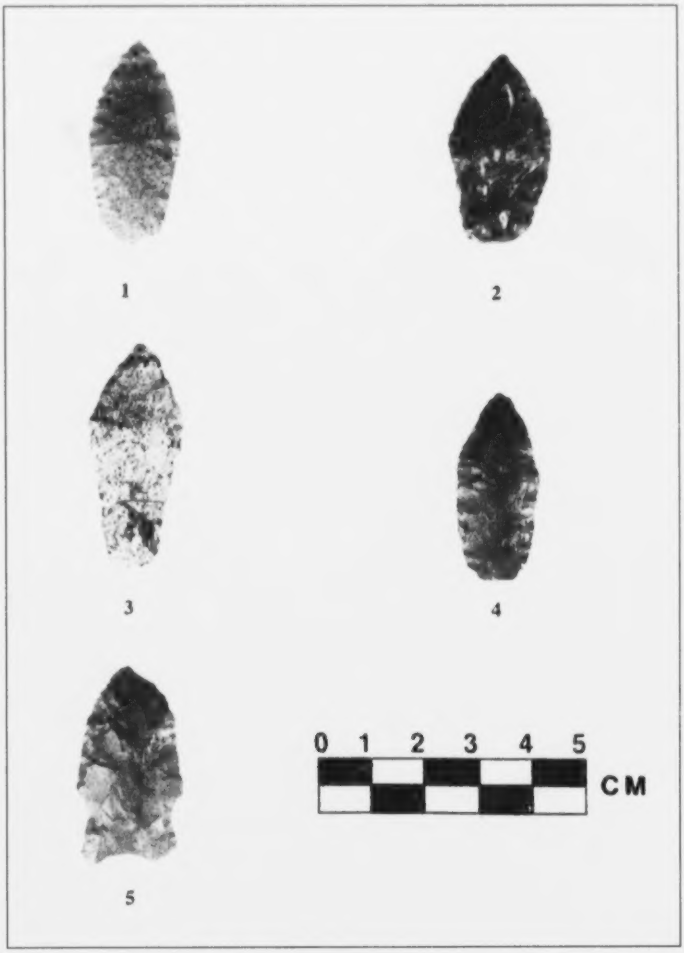

Figure 5.7 Complete Late Palaeo-Indian Projectile Points from the Deavitt, Draper and Draper Hi-Lo Sites.

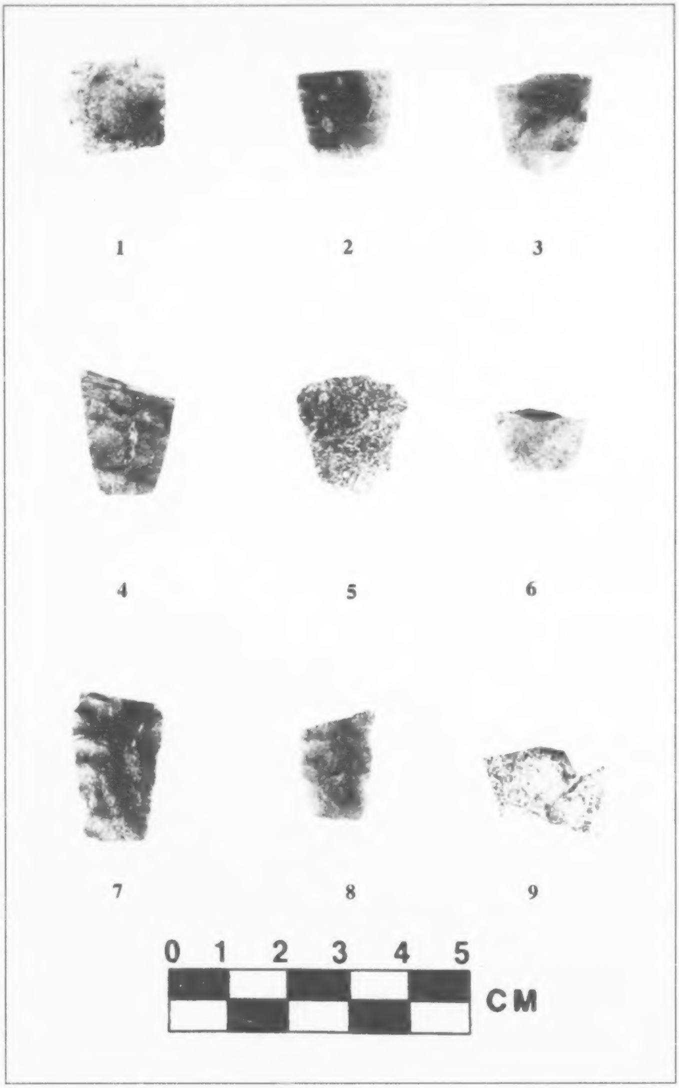

Figure 5.8 Proximal Ends and Mid-Sections of Late Palaeo-Indian Projectile Points from the Draper, Deavitt and Boyington Sites.

cortex at its proximal end.

TYPE 11 includes five quartz or quartzite artifacts.

TYPE 12 includes two cojoined artifacts from the Draper site made from a black basalt-like raw material.

TYPE 13 is made of a glossy black, coal-like raw material and is either an exotic chert or possibly channel coal, which is a common raw material for the production of chipped stone adzes associated with Late Palaeo-Indian Dalton-complex archaeological sites.

TYPE 14 most often consists of very tiny flakes that are not possible to further identify.

Bifacial Artifacts

PREFORMS (13) There are 13 complete or fragmentary preforms, ten from Deavitt and three from Draper (Table 5.2). For analytical purposes the sample is divided into six stages of biface production, ranging from the creation of blanks to final shaping.

Table 5.2 Metrics, Raw Material types and Manufacturing Stage of Preforms from the Deavitt and Draper Late Palaeo-Indian Sites.

Artifact No.	Locus	Length (mm)	Width (mm)	Thick. (mm)	Weight (g)	Raw Material	Stage
7Yk10.100	III	44.3+	31.6	10.1	15.2	2	I
BbGu-6.2		36	29.3	14.3	14.3	6	II
7Yk7.8 &.37		36	34.5	16.1	18.75	12	II
7Yk7.6		26.2	23.2	7.3	5	2	II
7Yk10.1	II	67.8	43.1	10.4	31.9	2	III
7Yk10.109	III/IV	55.1	40.4	12.3	27.8	1	III
7Yk10.138	IV	38.8+	33.8	9.1	7.5	3	III
7Yk10.15	1	56	30.2	8.9	16.1	1	IV
7Yk10.16	1	32.7	22	8.1	6.8	3	IV
7Yk10.500	V (E)	31	24.9	7	5.15	3	V
7Yk10.256 &.271	V (E)	47	20.7	4.7	5	2	VI
7Yk10.68	1	11.6+	19.2	4	1	3	VI
7Yk10.318	V(E)	22.5+	19.6	4.5	2.1	1	VI

Incomplete = +

STAGE I – The single specimen in this category is a thick corner-struck flake (7Yk10.100, Figure 5.6:1). The platform remains attached at the proximal end but the distal end is broken. Three small flakes have been removed from the right lateral edge of the flake blank, but they do not extend to the medial ridge. The ventral surface is unmodified.

STAGE II – The three specimens in this category are from the Draper (7Yk7/BbGu-6) site. 7Yk7.6, Figure 5.6:2 has been partly reduced along both surfaces, but only at one end. The flake scars are parallel. 7Yk7.8 and .37 co-join and are at a very early stage of reduction along both dorsal and ventral surfaces. BbGu-6.40 has been partially thinned along one lateral edge. There is a small area of retouch along this edge, which suggests that it was likely used as an expedient tool prior to loss or discard.

STAGE III – There are two specimens from Deavitt (7Yk10.1 and .109) where the dorsal and ventral surfaces have been worked so that the former medial ridges have been removed. The edges of the preforms are sinuous and neither specimen has been trimmed by secondary retouch. The flake scars are large and the overall shape of both specimens is oval. 7Yk10.1 retains part of its original platform at the proximal end (Figure 5.6:3). A third specimen is a partially formed biface that during the early stages of end thinning was rendered unsuitable

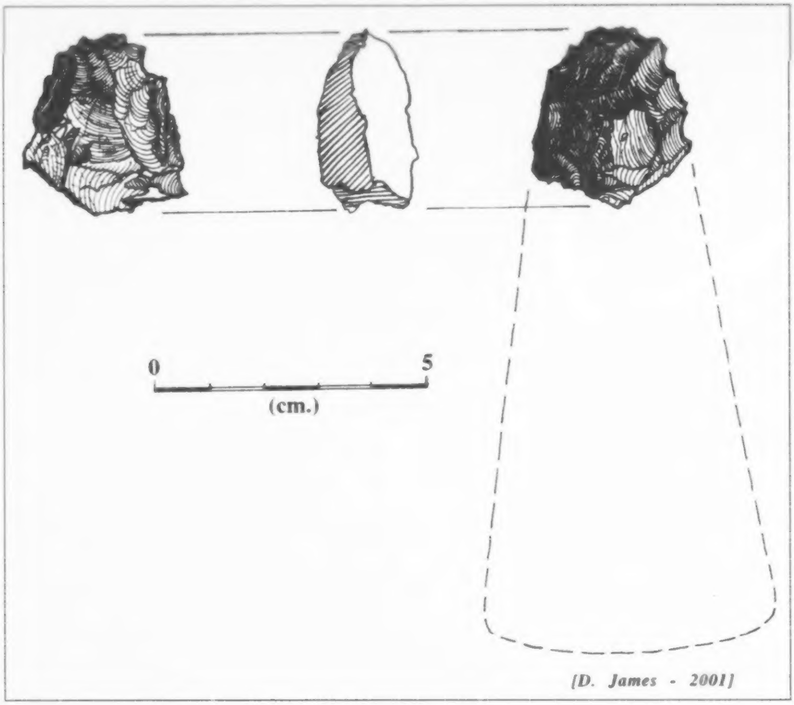

Figure 5.9 Chert Adze fragment from the Boyington Site.

for further refinement (7Yk10.138). During the process of end thinning, the artifact was struck with excessive force and at too low an angle; therefore, as a result, the flake carried further than was originally desired and it clipped off the opposite side of the biface. Specimens formed from this type of production error are known as outrepassé and/or reverse hinge flakes (Callahan 1979). The proximal end is thick and the edges are sinuous.

STAGE IV–The two specimens in this group retain parts of their original platforms and display secondary flaking (7Yk10.15 and 16). 7Yk10.15 is shown in Figure 5.6:4. The flake scars are shorter and closer together than in the previous stage. A specimen identical in form to 7Yk10.15, but slightly shorter (979.714.361), was recovered from the Bender Locality 3 site during Storck's (1979) Udora survey. The Bender Locality 3 specimen is made of Type 1 chert.

STAGE V–This specimen is partially-shaped but still retains a very small section of its platform at the proximal end (7Yk10.500; Figure 5.6:5). The dorsal surface has a medial ridge while the ventral surface is relatively flat. The right side of the ventral surface is serrated with a series of short flake scars. This is likely an attempt to isolate platforms for the removal of a series of flakes along the opposite side of the specimen for thinning purposes.

STAGE VI–Of the three specimens in this group, one is complete (7Yk10.256/271) and there are two proximal ends (7Yk10.68 and .318). At this stage the preforms are nearly com-

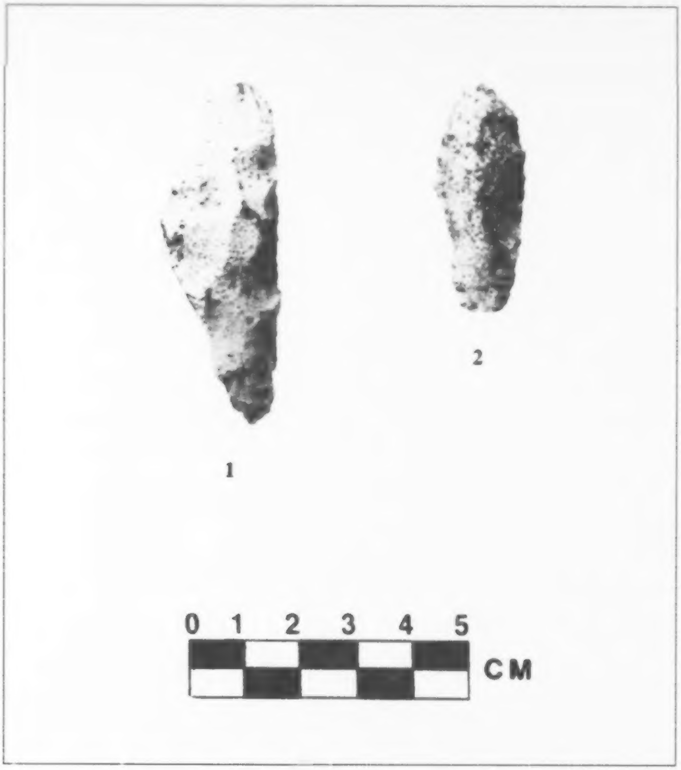

Figure 5.10 Backed and Single Shouldered Bifacial Knives from the Deavitt Site.

plete, the edges are serrated and the lower sections are largely contracting. The complete biface retains a slight medial ridge on its dorsal surface, whereas the ventral surface is almost flat. The serration along the lateral edges of the ventral surface was probably initiated in order to isolate platforms for the removal of a subsequent series of thinning flakes along the opposite surface (7Yk10.256/271). It is likely that during the removal of a thinning flake along the dorsal surface, the proximal end (tip) broke (Figure 5.6:6). A specimen almost identical to 7Yk10.256/571 is recorded in an Agate Basin component at the Hell Gap site in eastern Wyoming. The Hell Gap specimen was originally identified as a serrated knife but use-wear studies now suggest that it is a mid-late stage Agate Basin preform (Shelly and Agogino 1983).

PROJECTILE POINTS (28) There are 28 projectile points and fragments from the survey area. Six are complete, or nearly complete, projectile points (Table 5.3). Three are from Deavitt and one each from the Draper, Draper Hi-Lo and Lewis sites. The three specimens from Deavitt and the one from Draper have contracting stems with either parallel or sub-parallel flaking. The distal end of 7Yk10.541/706 has been resharpened (Figure 5.7:3). The later-

Table 5.3 Metrics, Raw Material, Grinding, Basal Shape and Edge Form for the Projectile Points from the Boyington, Badali, Cowieson-Fenton, Deavitt and Draper Late Palaeo-Indian Sites.

COMPLETE

Artifact No:	Locus	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Raw Material	Grinding Side(s) Base	Basal Shape	Edge Form
7Yk10.80	III	36	19.8	5	3.3	1	* * *	Convex	Contracting Stem
7Yk10.92	II	39	18	5	3.3	2	* * *	Convex	Contracting Stem
7Yk10.706/	V(E)	41.8	17.9	5.3	3.8	2	* * -	Convex	Contracting Stem
7Yk10.541									
BbGu-6.1		35	16	5.2	3.1	3	- * -	Straight	Contracting Stem
7Yk4.1		48.8	24.1	9.1	10.4	13	- - -	Convex	Pentagonal
7Yk41.1		36.7	20.1	8	5.8	6	* * *	Convave	Notched
PROXIMAL ENDS									
7Yk10.24	II	11	14.9	3.2	0.6	2	* * *	Straight	Contracting Stem
7Yk10.25	II	10.2	18.8	3.1	0.7	3	* - -	Convex	Contracting Stem
7Yk10.43	II	11.3	15.9	3.1	0.7	2	* * -	Convex	Contracting Stem
7Yk10.51	I	18.9	13.1	3.8	1.1	10	* * -	Straight	Slight Shoulder & Contracting Stem
7Yk10.260	V(E)	10.9	13.3	3	0.5	1	* * *	Convex	Contracting Stem
7Yk10.499	V(E)	24.4	15.3	4.1	2	5	* * -	Straight	One Side Straight, One Side Contracting
7Yk10.669	V(E)	5.8	11.6	2.7	0.3	1	* * *	Convex	Contracting Stem
7Yk10.941	V(H)	8.9	14.1	2.9	0.4	1	* * -	Shattered	Contracting Stem

Table 5.3 continues >

Artifact No:	Locus	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Raw Material	Grinding Side(s) Base	Basal Shape	Edge Form
MEDIA SECTIONS									
7Yk10.1032	V(H)	8	10.3	3.1	0.3	1	* - -	Concave	Contracting Stem
7Yk10.1342	V(H)	21.3	17.7	4.2	1.5	7	* * *	Straight	Contracting Stem
7Yk10.1442	V(H)	19.9	19.1	4.6	1.7	1	* * -	Shattered	Contracting Stem
7Yk10.1482	I	17.8	17.5	4.1	1.7	3	* * *	Convex	Contracting Stem
BbGu-25.4		42	25	6	6.1	4	* * *	Straight	Contracting Stem
BbGu-25.6		21.5	19	6	2.6	4	- - -	Convex	
7Yk3.1		11	13.6	2.8	0.4	2	* * *	Convex	Contracting Stem
7Yk7.3		16.1	19	4.4	1.8	2	* * *	Straight	Contracting Stem
7Yk11.1		15.3	17.3	4.1	1.2	3	* * *	Straight	Contracting Stem
7Yk10.1065	V(H)	10.9	6.1	2.9	0.2	2			
7Yk10.1069/	V(H)	16.4	20.2	4.2	1.2	1	* * -		Contracting Side
7Yk10.1315									
7Yk10.1251	V(H)	4.6		10.1	4.3	0.25	1		
DISTAL ENDS									
7Yk10.78	III	34.8	20.8	4.5	2	2			
7Yk10.133	IV	23	16.1	5.4	2	3			
7Yk10.1237	V(H)	4.4	5.7	2	-0.1	1			

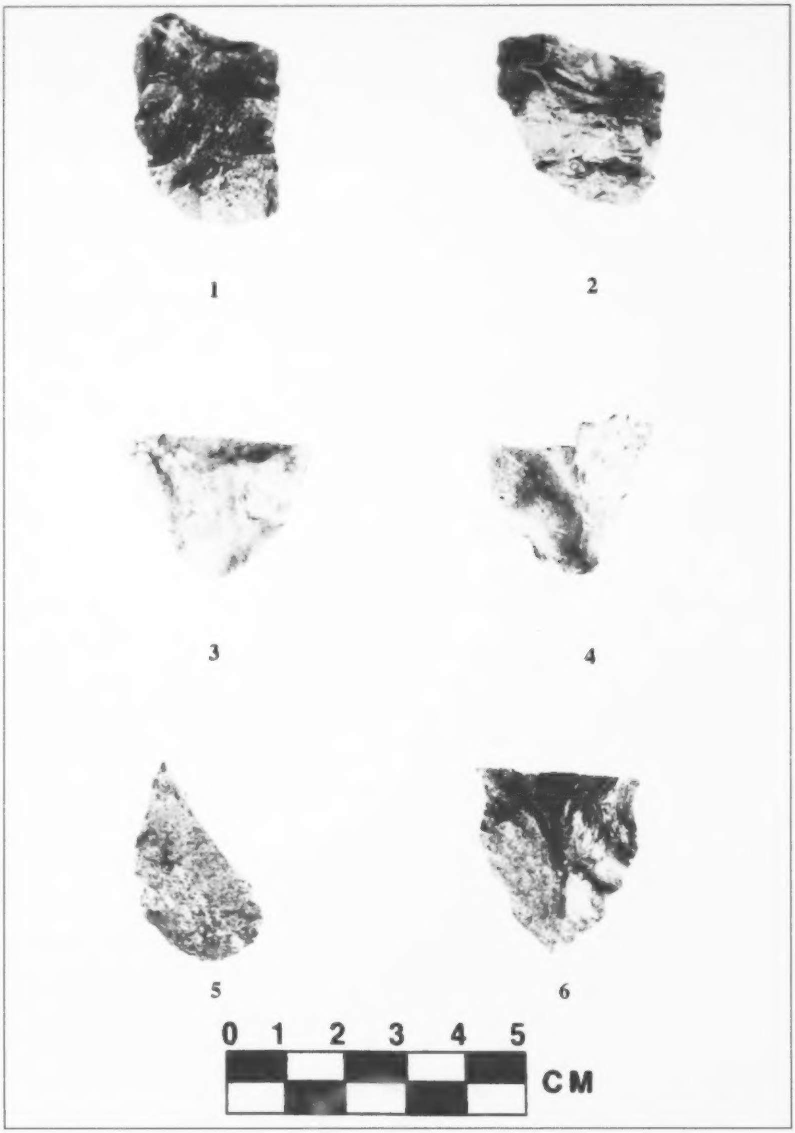

Figure 5.11 Bifacial Knife Fragments (Class V) from the Deavitt Site.

al edges at the proximal ends in this group of four specimens have been ground in order to prevent the abrasion of a binding agent affixing the projectile points to their foreshafts. The edges at the proximal end of 7Yk10.92 are broken on both sides (Figure 5.7:1). The proximal end of 7Yk10.80 retains a portion of platform belonging to the original flake blank, and a small section of one lateral edge is incompletely ground (Figure 5.7:2). The mean values for the complete contracting stemmed points from Deavitt and Draper are: length – 37.95 mm, width (at widest point) – 17.6 mm and thickness 5.05 mm. Stylistically the specimens resemble Hell Gap projectile points from the Casper site (Frison 1974:72–80). The Lewis specimen (7Yk4.1) is made of semi-translucent quartz. The flake scars, which are mare-parallel to sub-parallel, and the flakes removed from the proximal end give it a scraper-like appearance. This projectile point is pentagonal in outline and stylistically resembles several Late Palaeo-Indian specimens recovered from the Plenge site in New Jersey (Kraft 1973, Plate 6c–e). The projectile point from the Draper Hi-Lo (7Yk41.1) site also has parallel to sub-parallel flaking. Along the base of the blade there is a waist, as opposed to notching which is, in addition to the ears and proximal end, heavily ground (Figure 5.7:5). The base is concave and the distal end has been broken by an impact fracture. It is stylistically similar to Hi-Lo projectile points from Southwestern Ontario (Ellis and Deller 1982) and Michigan (Fitting 1963), and to Dalton complex projectile points of the Mississippi valley (Morse and Morse 1983:73). Both Dalton and Hi-Lo are considered to be Late Palaeo-Indian.

There are 17 proximal ends, or bases, of which 15 appear to be contracting stemmed and two have poorly defined shoulders (7Yk10.51 and .499). One side of 7Yk10.499 is straight while the other contracts towards the base. Twelve are from Deavitt, two are from Badali and one each, from Boyington, Cowieson-Fenton and Draper. Six have straight bases, eight have convex bases and one has a concave base. One specimen has been crushed so that it is impossible to determine its original shape (7Yk10.941). All have lateral edge grinding but six have not been ground along their proximal ends, or the edges have been damaged to such an extent that it is impossible to determine if this trait was present. Three specimens are fire spalled. Eight proximal projectile point ends, or bases, are illustrated in AND 5.7:1–8.

Two specimens are medial sections of contracting stemmed points and have been ground along their lateral edges. Two fragments (7Yk10.1069/1315) have been mended (Figure 5.7:9) and it is possible that another specimen (7Yk10.1056) also belongs to this particular artifact.

There are three distal sections (tips), all from the Deavitt site. Considering its minute size, one tip (7Yk10.1237) was probably produced when a projectile point shattered against the bone of a hunted animal. Frison (1973:98) illustrates similar impact fragments from the Late Palaeo-Indian Casper site in central Wyoming.

PERFORATORS (2) There are two specimens in this category, one from Deavitt and the other from the Cowieson-Fenton site (7Yk10.31 and 977.174.689). Both are made from a reused biface fragment that was once the proximal end of a contracting stemmed point; the spurs or projections are at the distal end. 7Yk10.31, made of Type 1 chert, is 24.8 mm long, 11.2 mm wide, 4.8 mm thick and weighs 1.2 grams. The spur is 9.8 mm long, and 6.9 mm wide; its lateral edges have been crushed by past usage. Specimen 977.174.689, made of Type 2 chert, is 30 mm long and 15 mm wide. Other measurements for this specimen could not be obtained due to the inability to gain access to the collection at the Department of Anthropology, Royal Ontario Museum.

ADZE FRAGMENT (1) One artifact is possibly the poll end of a chipped stone adze (Figure 5.9). flakes have been removed from one lateral edge, and the end displays damage similar to

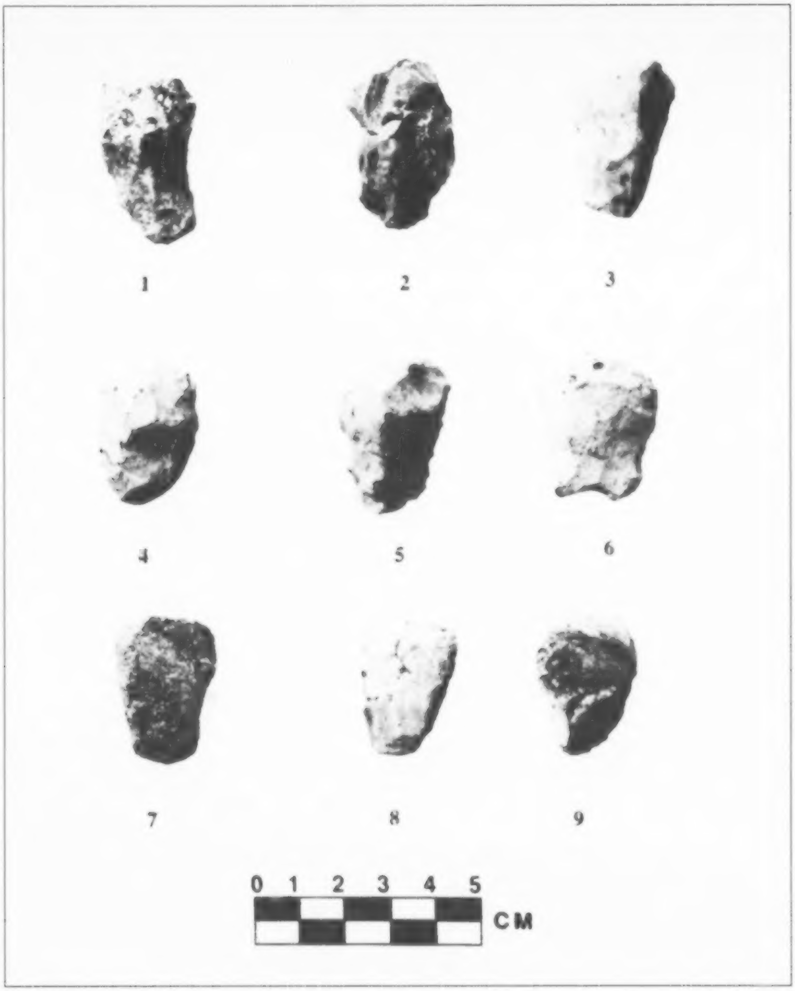

Figure 5.12 End Scrapers from the Deavitt and Draper Sites.

that seen on later period ground stone adzes. Although adzes have not been reported from Palaeo-Indian assemblages in southern Ontario, this tool type is relatively common in Late Palaeo-Indian, Dalton complex, assemblages from the central Mississippi valley (Morse and Goodyear 1973; Morse and Morse 1983). Dalton adzes are also made from either chert or chunnel coal. Figure 5.9 presents a possible outline for the adze from the Boyington (7Yk11) site, based on complete specimens from Dalton assemblages.

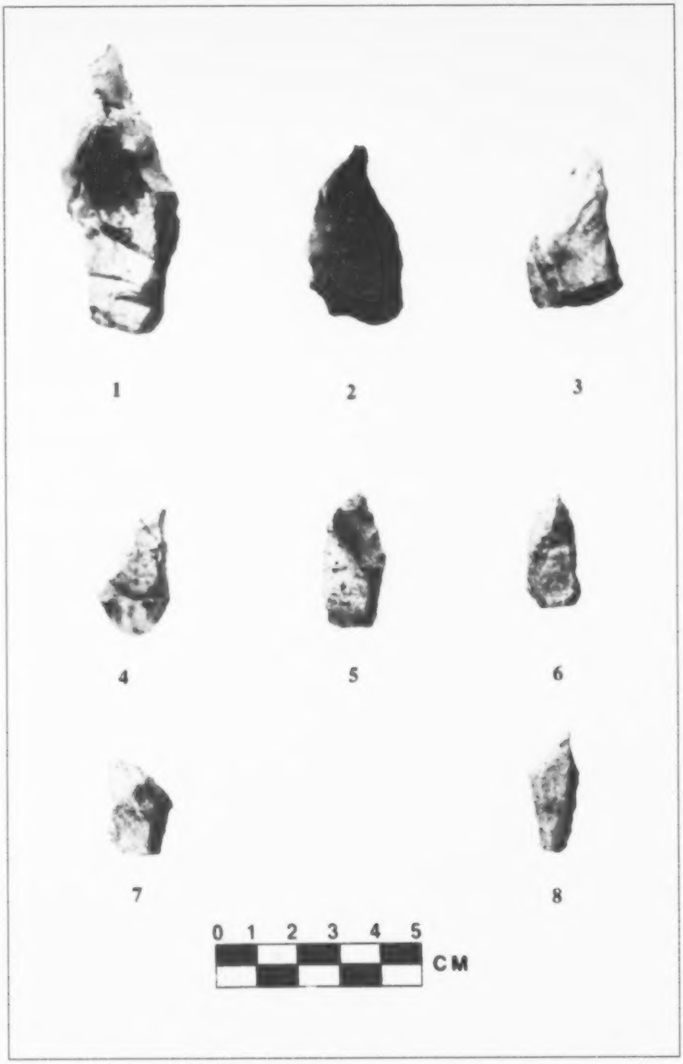

Figure 5.13 Beaked Scrapers from the Deavitt Site.

BIFACIAL KNIVES (26) Six classes of bifacial knife are described.

CLASS 1–This specimen shows a single shoulder (7Yk10.30, Figure 5.10:2) and is made of Type 2 chert. The serrated edges and accompanying edge crushing suggest that it was likely employed as a knife. It has a thick medial ridge, and two small thinning flakes have been removed from the proximal end. The specimen is 40.5 mm long, with a maximum shoulder width of 16.5 mm, 7.0 mm thick and weighs 3.9 g. A similar single shouldered knife

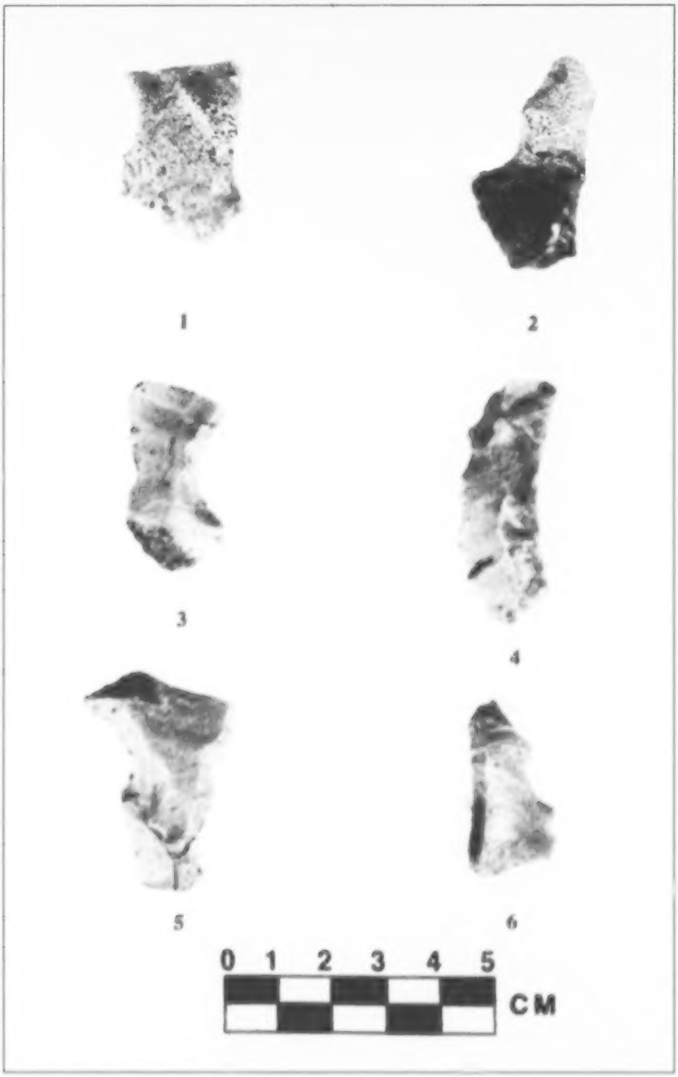

Figure 5.14 Spokeshaves, Composite Scraper and Side Scraper from the Draper, Deavitt and Badali Sites.

occurs in a possible Late Palaeo-Indian component in Wisconsin (Mason 1985).

CLASS II – There are two backed bifacial knives, one from Deavitt and the other from the Dudley Isolated (7Yk36.2) site. The right lateral edge of 7Yk10.42 is serrated, and flakes have been removed along both faces. There is minor crushing along sections of the working edges and the left lateral edge has been purposely dulled. The specimen is 60.8 mm long, 21.2 mm wide, 8.2 mm thick and weighs 9.2 g; the length of the cutting edge is 56.0 mm (Figure 5.10:1). The Dudley (7Yk36.2) specimen is 47.2 mm long, 27.1 mm wide and 8.6 mm thick. The specimen weighs 10.6 grams and has cortex along one side while the other side is serrated. Specimen 7Yk10.42 is made of Type 2 chert and 7Yk36.2, of Type 1 chert.

CLASS III –The single specimen in this class is from the Badali (BbGu-25) site. It is triangular in shape and has been snapped at its distal end. The flake scars terminate along the

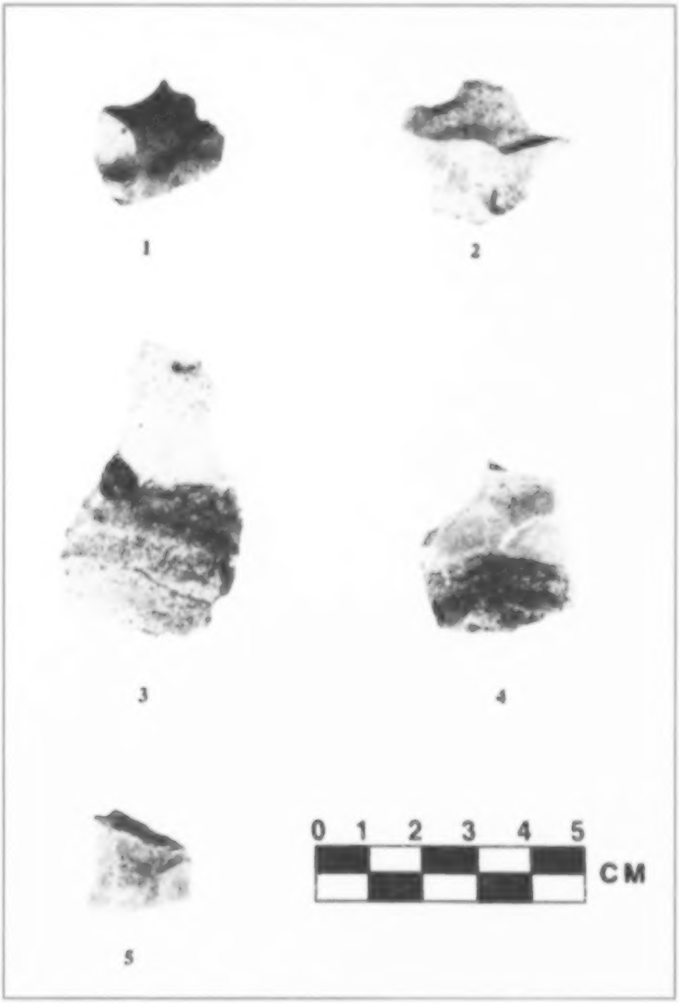

Figure 5.15 Gravers and Side Scrapers from the Deavitt Site.

dorsal and ventral surfaces, forming a medial ridge. Both lateral edges and the proximal end possess flake scars that are shallow. The lateral edges are serrated. The specimen, which is made of Type 2 chert, is 52 mm long, 37.5 mm wide (at proximal end) and 8.5 mm thick, and it weighs 13.5 grams.

CLASS IV – This artifact (7Yk10.149) is either a bevelled biface or a sickle. It was found about 200 meters south of Area V at Deavitt and is probably not associated with the Late Palaeo-Indian occupation of this site. It is similar in style to an Early Palaeo-Indian artifact type, known as a sickle, which was found at the Arc and Lamb sites in New York State (Gramly and Vanderloan 1986; Gramly 1992). It also resembles a category of artifacts, known as alternately bevelled bifaces, which have been found at Early Palaeo-Indian sites such as Crowfield in southwestern Ontario (Deller and Ellis 1988). 7Yk10.149, made of Type 3 chert, is steeply bevelled along one side near its distal end.

CLASS V – Of the nine specimens in this class, 6 are from Deavitt (Figure 5.11:1–6), and there are single specimens from Cryderman, Draper Hi-Lo and Prideaux Locality 14. All are made from thick flakes, have sinuous edges and are either complete and/or large fragments of bifacial knives.

CLASS VI – This class consists of miscellaneous biface/knife fragments. Of the 12 specimens, 10 are from Deavitt, one is from Cowieson-Fenton, and one is from Draper. These fragments are either too small or too broken to determine the actual shape of the artifact. Two specimens in the sample are more-or-less complete (including one from Deavitt and one from Cowieson-Fenton), but have major portions of their original forms damaged or missing due to k shatter or some other form of breakage. There are 5 end sections, 3 medial sections, and two edge fragments. 7Yk10.439 is an edge fragment that was removed from the original biface due to spalling, along a flaw within the raw material. 7Yk10.232 is an edge fragment that was produced by artifact refurbishing. This specimen is probably a fragment of 7Yk10.205/1107, which has been included within Class V.

Unifacial Artifacts

END SCAPERS (29) The 29 end scrapers in the sample include 26 from Deavitt (Figure 5.12:1–8) and three from Draper (Figure 5.12:9 and Table 5.4). There are 23 specimens with all, and/or large, portions of their proximal platforms intact (9 have been trimmed but are otherwise complete artifacts); six are damaged at their proximal ends so that length measurements are incomplete. The 23 complete specimens have mean values of: length – 29.7 mm, width – 23.2 mm, thickness – 12.3 mm and weight – 6.6 g. The six incomplete specimens have mean values of: length – 23.8 mm, width – 19.4 mm, thickness – 7.1 mm and weight – 3.9 g. There are five lithic raw material groups represented in the end scraper sample: 10 – Type 1 (Balsam Lake), 12 – Type 2 (Fossil Hill), 5 – Type 3 – (Gull River), 1 – Type 4 (Onondaga) and 1 – Type 12 (Quartz). Three end scrapers are fire-spalled. Figure 5.12 shows 9 of the complete end scrapers from the sample.

BEAKED SCRAPERS (15) These are considered by some researchers to be a "fossil" tool-type, which is commonly recovered from Palaeo-Indian contexts throughout most of North America. In general, a beaked distal end and slug-like shape characterize them. The lateral edges of most beaked scrapers are steeply trimmed and it is not unusual for the flakes upon

Table 5-4 Metrics, Raw Material and Platform Descriptions for the End Scrapers from the Deavitt (7Yk10) and Draper (7Yk7/BdGu-6) Sites.

Specimen no:	Length (mm)	Width (mm)	Bit Thickness (mm)	Raw Weight (g)	Angle °	Material	Platform (yes/trim/no)	Comments
7Yk10.17	33	28.2	15.3	12.9	30	3	T	Steep Back
7Yk10.36	32.4	21.7	10.5	7.1	50	2	T	
7Yk10.50	30.2	35.5	16.1	13.6	35	11	Y	
7Yk10.60	11.2*	19*	4.8	0.8	39	4	N	Fire Spalled
7Yk10.91	26.3	15.2	7.4	3.5	73	2	Y	
7Yk10.134	31.9	26.1	9.1	8.3	62	2	T	
7Yk10.136	31.4	27.3	7.1	3.9	41	3	Y	Narrow Sides
7Yk10.172	34.4	23.3	9.4	9.1	45	2	Y	
7Yk10.190	24.2*	21.8	5.9	3.9	34	1	N	
7Yk10.229	23.9	17.8	6.8	3.4	60	2	Y	
7Yk10.254	36.9	24.5	16	3.7	68	1&3	Y	Steep Back
7Yk10.255	37.8	22.9	15.3	11.2	73	1	Y	Steep Back
7Yk10.259	27.4	23.6	8.2	4.2	58	2	T	
7Yk10.360	32.7	21.4	6.6	4.4	48	1	Y	
7Yk10.368	22.3	21.8	5.7	3.5	44	1	Y	
7Yk10.438/1466	29.1	26.3	7.9	7	45	1	T	Fire Spalled
7Yk10.572	27.4	23.2	6.8	3.7	53	1	Y	
7Yk10.789	23.4*	24.8*	8.6	8.2	54	2	N	
7Yk10.989	28.1*	18	5.7	3	37	3	N	Serrated
7Yk10.991	29.8	20.7	9.3	6.6	62	1	T	
7Yk10.1170	28.8	21.5	7.9	3.9	46	2	N	
7Yk10.1271	22.7*	18.2*	10.2	3.7	48	2	T	
7Yk10.1306	34.2	22.1	12.4	10	62	2	Y	
7Yk10.1373	26.4	18.6	5.6	3.3	52	1	T	
17Yk10.1469	28.4	21.3	5.4	4.4	50	2	T	
7Yk10.1483	21.5	17.7	6.1	2.1	62	1	Y	
7Yk7.4	32.6	21.2	7	5.5	66	2	Y	
7Yk7.14	27*	15.4	7.6	2.9	67	3	N	Fire Spalled
7Yk7.29	27.4	19.3	8.8	4.2	50	3	T	*=Incomplete

which they are made to be somewhat humped toward the distal end. In the Northeast, these tools have been recovered from Early Palaeo-Indian contexts at Banting (Storck 1979a), Parkhill (Deller 1980) and Potts (Gramly and Lothrop 1984). The only Late Palaeo-Indian site where this tool has been reported is the Parkhill site, Saskatchewan (Ebell 1980; Nero 1959).

The 15 beaked scrapers comprise two classes. The first class consists of 14 specimens: 13 from Deavitt and 1 from Cowieson-Fenton. The Cowieson Fenton specimen is not included in the sample comparisons because it lacks complete measurements.

CLASS I consists of eight complete specimens from Deavitt (Figure 5.13:1–8) which have mean values of: length – 37.1 mm, width – 18.7 mm, thickness – 15.7 mm and weight 8.6 g. Controlled flaking at the proximal ends of three artifacts (7Yk10.45, .203 and .851) suggests that they may have been hafted into a slotted handle for either wood and/or bone working purposes. There are three proximal end sections within this class. 7Yk10.177, which has been worked along both lateral edges, and tapers toward the end, may also have been fitted into a slot-type handle. The three proximal end sections have mean values of: length – 25.7 mm, width – 15.3 mm, thickness – 8.2 mm and weight – 3.6 g. There is a distal end fragment (7Yk10.571) and a medial lateral edge section (7Yk10.1492) in the sample from Deavitt. 7Yk10.471 is 12.0 mm long, 6.2 mm wide, 6.0 mm thick and weighs 0.4 g. Ten specimens from Deavitt are made of Type 2 chert (7Yk10.4, 45, 65, 203, 851, 788, 919, 959 and 1492), two from Type 1 chert (7Yk10.10.177 and 175) and one is made of Type 4 chert (7Yk10.128). The single specimen (977.174.689) from the Cowieson-Fenton site is made of Type 2 chert.

CLASS II consists of a single specimen (7Yk10.130) which is short and stubby and wider than it is long. This specimen has a pentagonal outline, as well as, a small pointed beak at the mid-point of its distal end. Cortex adheres to much of the original flake which is Type 12 chert. The specimen is 31.2 mm long, 36.4 mm wide, 13.8 mm thick and weighs 19.6 g.

COMPOSITE SCRAPER(1) Specimen 7Yk10.668 has traits that suggest it was used for multiple purposes (Figure 5.14:5). Along the right margin, at the proximal end, there is a small spur that may have been used for graving. The right lateral edge possibly functioned as a side scraper and the mid-section of the left lateral edge is concave and was likely used as a spokeshave. The distal end is broken but the projection on the upper left lateral edge suggests that it may have been a spurred variety of end scraper. It is 41.0 mm long, 28.9 mm wide, 5.8 mm thick, weighs 6.1g and is made of Type 2 chert.

SIDE SCRAPERS (20) The 20 specimens have been sorted into six classes: sixteen are from Deavitt, two are from Badali and there is one each from Cowieson-Fenton and Draper.

CLASS I includes three specimens: one nearly complete (7Yk10.2, Figure 5.15:3), one distal end (7Yk10.175, Figure 5.15:4) and one proximal end (7Yk10.167, Figure 5.15:5). They represent specialty implements with steep scraping edges along both lateral margins. The proximal ends of the specimens are slightly humped and the two nearly complete specimens include modified cortical material. The distal or bit ends possess traits similar to spokeshaves in that they tend to be steeply retouched and concave along at least one lateral margin. The distal ends also have spurs, which could have functioned as either gravers or perforators. All three specimens are made of Type 2 chert and are from Area II at Deavitt.

CLASS II includes four specimens that are made from thick flakes and have slightly con-

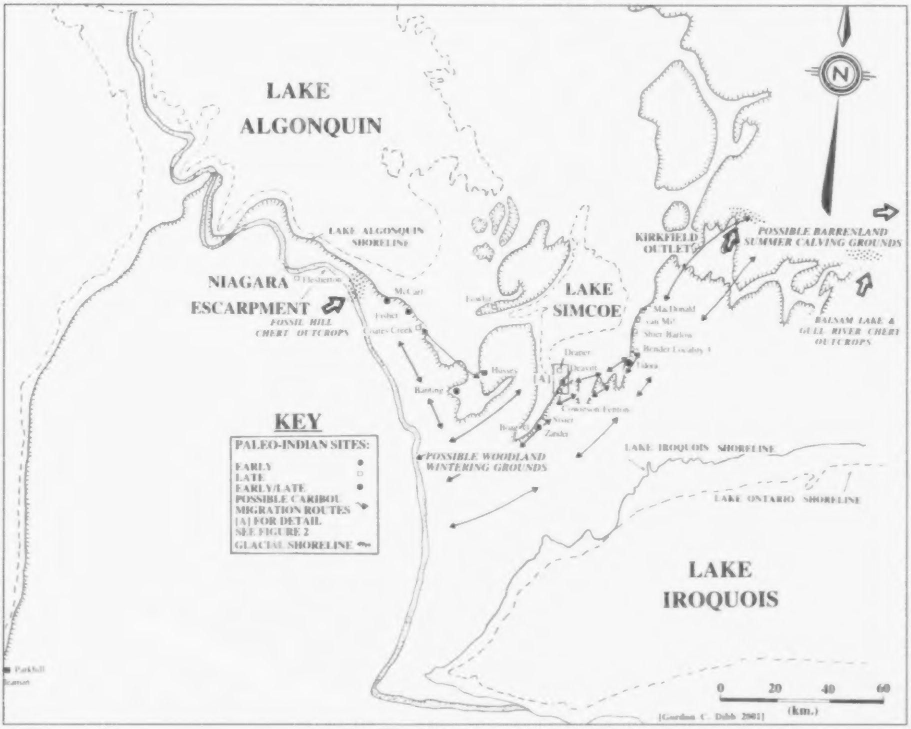
LAKE ALGONQUIN
LAKE ALGONQUIN SHORELINE
NIAGARA ESCARPMENT
FOSSIL HILL CHERT OUTCROPS
Flesherton
McCarl
Fisher
Coates Creek
Fowler
Banting
Hussey
LAKE SIMCOE
Draper
Deavitt
[A]
Cowieson-Fenton
Sister
Zander
Boag Cr.
KIRKFIELD OUTLET
POSSIBLE BARRENLAND SUMMER CALVING GROUNDS
MacDonald
van Mil
Sister Barlow
Bender Locality 1
Udora
BALSAM LAKE & GULL RIVER CHERT OUTCROPS
POSSIBLE WOODLAND WINTERING GROUNDS
LAKE IROQUOIS SHORELINE
LAKE ONTARIO SHORELINE
LAKE IROQUOIS
KEY
PALEO-INDIAN SITES:
EARLY
LATE
EARLY/LATE
POSSIBLE CARIBOU MIGRATION ROUTES
[A] FOR DETAIL SEE FIGURE 2
GLACIAL SHORELINE
N
Parkhill
0 20 40 60
(km.)
[Gordon C. Dibb 2001]

Figure 5.16 Late Palaeo-Indian Sites Located Along the Algonquin Strandline in Relation to Possible Barren Ground Caribou migration Routes and Chert Sources.

vex scraping edges. Two are from Deavitt, one is from Badali and one is from Cowieson-Fenton. They have mean values of: length – 44.1 mm, width – 34.7 mm, thickness – 10.0 mm and weight – 14.3 g. One artifact from Deavitt and one from Cowieson-Fenton is made of Type 2 chert; one artifact from Deavitt is made of Type 1 chert; and the specimen from Badali is of Type 4 chert. The Cowieson-Fenton (7Yk3.3) side scraper has scraping edges along opposite sides.

CLASS III includes four artifacts from Deavitt. They consist of tabular flakes that have scraping edges along one lateral edge. 7Yk10.365/560/637 are fire spalled. Specimens have mean values of: length – 28.6 mm, width – 20.9 mm, thickness – 20.4 mm and weight – 3.4 g. 7Yk10.365/560/637 and 7Yk10.460/599 are made of Type 1 chert and 7Yk10.561 and 7Yk10.241 are made of Types 2 and 3 chert, respectively.

CLASS IV includes three artifacts from Deavitt (7Yk10.79, 249/1121 and 1473) made of Type 1 chert. The specimens are long and narrow and have been worked along both lateral edges, and in the instance of 7Yk10.1473, along the distal end. All specimens still have portions of their original platforms at their proximal ends. This category of artifacts is similar in style to a Palaeo-Indian unifacial tool class known as *flakeshavers* (Grimes and Grimes

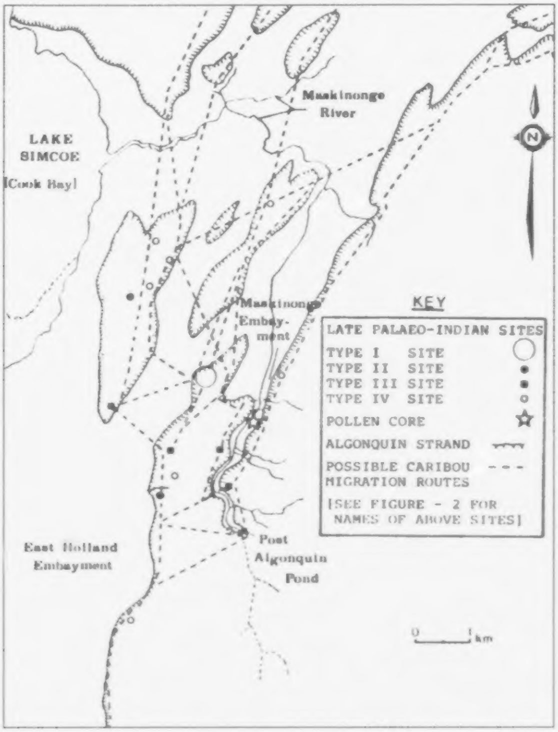
Maskinonge River
LAKE SIMCOE
[Cook Bay]
N
Maskinonge Embayment
KEY
LATE PALAEO-INDIAN SITES
TYPE I SITE ○
TYPE II SITE ●
TYPE III SITE ■
TYPE IV SITE o
POLLEN CORE ☆
ALGONQUIN STRAND
POSSIBLE CARIBOU MIGRATION ROUTES - - -
[SEE FIGURE - 2 FOR NAMES OF ABOVE SITES]
East Holland Embayment
Post Algonquin Pond
0 1 km

Figure 5.17 Possible barren ground caribou migration routes as they relate to Late Palaeo-Indian sites along the former Algonquin strandline in the Maskinonge (Jersey) and East Holland River Embayment areas.

1985:35–57). Specimens have mean values of: length – 31.3 mm, width – 17.3 mm, thickness – 3.9 mm and weight 2.3 g.

CLASS V is a thick discoidal scraper with continuous retouch around its margins. It is made of Type 4 chert and is from the Badali (BbGu-25.7) site. Two large flakes have been removed from its ventral surface. The artifact is 51.0 mm long, 47.0 mm wide, 10.0 mm thick, and weighs 17.72 g.

CLASS VI includes 5 specimens: four from Deavitt and one from Draper, which all have scraping edges along one or more of their lateral margins. 7Yk10.489 is made of Type 1 chert, 7Yk10.513 and 7Yk7.7 are made of Type 2 chert, and 7Yk10.53 and 7Yk10.69 are made of Type 3 chert. Mean values are: length – 25.38 mm, width – 21.2 mm, thickness – 5.76 mm and weight – 3.4g. 7Yk10.513 is illustrated in Figure 5.14:6.

END AND SIDE SCRAPER FRAGMENTS (5) There are five scraper fragments in the sample, all from Deavitt. 7Yk10.137 and 7Yk10.200 are small fragments of end scraper bits made of Types 2 and 1 chert, respectively. 7Yk10.120, 623 and 1005 are sections of side scrapers. They are made of Types 1, 10 and 2, respectively.

SPOKESHAVES (9) The nine specimens are characterized by concave scraping edges: four are from Deavitt (Figure 5.14:2–3) two are from Prideaux Locality 14 and one each from Badali, (Figure 5.14:4) Cowieson-Fenton and Draper (Figure 5.14:1). The two Prideaux Locality 14 specimens will not be discussed further due to a lack of metric data. The mean values of the seven remaining specimens are: length – 34.7 mm, width – 22.5 mm, thickness – 6.1 mm and weight – 4.8 g. Six specimens are made of Type 2 chert (977.174.55 and .56, 7Yk3.2, 7Yk7.15, 7Yk10.910 and BbGu–25.1), two are made of Type 3 chert and one is made of Type 1 chert.

GRAVERS (7) There are seven gravers, three from Cowieson-Fenton, three from Deavitt (Figure 5.15:1 and 5.15:2) and one from Badali. They are characterized by finely chipped and often very fragile projections, or spurs along either their distal ends or lateral margins. BbGu-25.10 and 7Yk10.3 are made of Type 4 chert and 7Yk10.632 and 7Yk10.99 are made of Types 1 and 2 chert, respectively.

DRILL (1) The unifacial drill from Cowieson-Fenton is made of Type 1 chert. The specimen is 29.3 mm long, 16.9 mm wide, 8.2 mm thick, and weighs 3.15 g.

FLAKE KNIFE (1) The Dudley Isolated site produced a unifacially flaked knife made of Type 1 chert. A row of small flakes has been removed from one lateral edge along the ventral surface of the specimen (7Yk36.1). The artifact is 54.9 mm long, 22.8 mm wide, 8.7 mm thick and weighs 7.25 g. The length of the cutting edge is 30.0 mm. The platform has been removed, and along the dorsal surface a prominent ridge veers to the left at the distal end.

RETOUCHED FLAKES (83) Of 83 retouched flakes, 66 are from Deavitt (includes 2 cojoins), 2 are from Badali, 5 are from Cowieson-Fenton, 7 are from Draper, and 3 are from Perry. It is likely that most were used for specific short term cutting or scraping tasks and subsequently discarded.

Debitage

FLAKES AND/OR SHATTER FRAGMENTS (1500) Of the 1500 flakes and/or shatter fragments recovered from the project area, 1407 (93.8%) are from Deavitt. For the Deavitt sample, 1072 (71.5%) specimens weigh less than 0.2 g. Under normal circumstances most of this material would have been lost through the 6-mm mesh hardware screening used at the beginning of the excavations (58 specimens were obtained by water screening the fill from Feature 4, Locus E). These specimens are either very small resharpening flakes, flake fragments, or minute shatter fragments. Specimens weighing between 0.2 and 1.0 g are primarily flakes removed near the final stages of the manufacture of biface blanks, which would have been brought to the site in anticipation of future demand. Most of the material that is approximately 1.0 g or larger, are shatter fragments derived from cores, which were either brought to the site from a considerable distance and/or were obtained from local riverine or till sources.

CORES (12) Twelve cores were recovered, five from Deavitt, three from Draper and two cores each from the Jersey Sideroad and Perry sites.

Discussion

The archaeological sites and find spots described above belong to what is referred to as the Late Palaeo-Indian Madina phase. Situated along the former margins of early post-glacial Lake Algonquin, these sites overlook the contemporary Lake Simcoe-Georgian Bay lowlands. The Main Phase of Lake Algonquin is thought to have lasted from about 11,000 to 10,500 B.P. This phase terminated with the opening of the Kirkfield Outlet, which allowed the water in the Lake Simcoe-Georgian Bay basin to be drained through the Trent system into Lake Ontario. Water from the Ontario basin subsequently drained via an outlet at Rome, New York into the Hudson River and the Atlantic Ocean (Dreimanis 1977; Jackson *et al.* 2000:425–440; Karrow *et al.* 1975:49–87).

One of the few Late Palaeo-Indian sites in southern Ontario where an attempt has been made to estimate the age of an associated strandline is Coates Creek, which Storck (1978b:25–26) relates to Lake Ardtrea and assigns a tentative date of younger than 10,400 B.P. However, Jackson *et al.* (2000) believe that Ardtrea in the southern Huron basin has been misidentified as Main Algonquin. To the south of Keswick, Areas II–V at the Deavitt site are located along a higher strandline that was possibly associated with drainage episodes of Lake Ardtrea. The Deavitt Area I and Badali sites are located along a slightly lower strandline, to the immediate north. This lower strandline is possibly associated with the Upper Orillia phase of post-Algonquin drainage (William Fitzgerald, personal communication; Eschman and Karrow 1985:89; Jackson *et al.* 2000:435).

The 10,070 B.P. date from Rose Swamp represents early pollen Zone 2. On this basis, Deavitt and the surrounding Late Palaeo-Indian sites should date to the slightly earlier pollen Zone 1/2 transition period, when spruce and pine were still dominant, and small amounts of larch, fir, birch, elm and oak were just beginning to appear on the landscape. The very late Zone 1 dominant vegetation of spruce and sedge compares with modern forest-tundra and in such an environment, hunter-gatherers could have hunted resources such as barren ground caribou, hare, and ptarmigan.

Figure 5.16 shows possible migration routes (if the dominant game was caribou), with the summer calving grounds located along the margins of the Kirkfield Outlet and upper Trent valley where the land is flat and quite rocky. The wintering grounds would likely have been located to the south/southwest, inland from the former Algonquin lakebed, between Lake Ontario and the Niagara Escarpment. The cluster of Late Palaeo-Indian sites between the communities of Queensville and Keswick, of which the Deavitt site is the largest, was situated along a treeless hilltop with panoramic views of adjacent uplands (islands) and embayment margins, along what would eventually become the East Holland and Maskinonge river valleys. Barren ground caribou could have been intercepted at water crossings between the adjacent upland areas and/or while they browsed on sedges and spikemoss along the valley margins (Figure 5.17).

Lithic resources could have been accessed while monitoring herds near the calving grounds in the Kirkfield area, and further east. Balsam Lake chert sources have been located at Indian Point and Grand Island near Kirkfield and in Lake Katchewanooka between Lakefield and Youngs Point. Gull River chert sources have been found at Cassidy and Bryson Bays on Clear Lake and near Warsaw. During the late fall or early spring, collecting parties probably went to the area west of Collingwood in order to obtain lithic raw materials from exposed chert outcrops belonging to the Fossil Hill formation (Eley and von Bitter 1985; 1989).

Deavitt (which includes Badali) is one of the largest known Late Palaeo-Indian base camp type sites on record in the Northeast-Great Lakes region. Very little data is available in the literature that can be used for comparative purposes concerning inter-site patterning during this period. Some Early Palaeo-Indian sites, which have been recorded with multiple activity areas, include: Bull Brook 1, Massachusetts with 42+ (Grimes 1979), Debert, Nova Scotia with 11 (MacDonald 1968), Fisher, Ontario with 19 (Storck 1997), Parkhill, Ontario with 10 (Deller 1980), and Udora, Ontario with 11 (Storck 1980). The largest of the Late Palaeo-Indian sites is Deavitt with 6 geographically distinct areas (including Badali) with each composed of from 3 to 5 clusters of artifacts. Each cluster probably represents the site of either a former tent ring and/or exterior activity area, such as drying and/or storage racks or tool refurbishing areas. The surface clusters are from 7 to 10 meters in diameter. The Deavitt site covers an area of about 10 hectares; however there are areas to the west (woodlot) and southeast on the property that have never been surveyed. Other Late Palaeo-Indian sites on record in the Northeast-Great Lakes area include: Draper, Ontario with 2 activity areas (Dibb 1992), Cummins, Ontario with 5 (Dawson 1983), Holcombe, Michigan with 3 (Fitting *et al.* 1966) and Welke-Tonkonoh, Ontario with 5 (Ellis and Deller 1992).

There is a major difference in the tool kits that belonged to the Early and Late Palaeo-Indian groups. The former used a point with a medial channel made by the removal of longitudinal flakes from the basal end, and known as "fluted points." Whereas, the latter groups used contracting stemmed (lanceolate) projectile points that were similar in shape to those used by their immediate predecessors, but lacked the medial channels. Other implements used by both groups include end scrapers (although the spurred variant of end scrapers were almost exclusively used by Early Palaeo-Indians), side scrapers, beaked scrapers, limaces, bevelled knives, and flake gravers.

Madina projectile points, as described by Dibb and Ellis (1988:20), have complete specimen lengths ranging from 36 to 88 mm, stem lengths from 16 to 35 mm, blade lengths from 14 to 53 mm, widths from 18 to 28 mm, and thickness ranging from 3 to 11 mm. Since 1988, two complete specimens have been found that fall within the same general metric ranges. One Madina projectile point has been recorded at the Caldwell site near Peterborough (Dibb 1988) and the other at the Draper site near Keswick (Dibb 1992). These points have straight-sided stems which contract from slightly developed (1 to 3 mm) shoulders towards a generally convex or straight base with rounded corners. The stem edges and bases are usually ground. Fore-sections have slightly convex edges with the maximum point width being at or just above the mid-point. The cross-sections are flat biconvex in shape. The surface flaking generally consists of a narrow, shallow, well-executed retouch, that ranges from parallel to patterned retouch and unpatterned in execution. Some specimens retain remnants of broader thinning flake scars along their fore-section surfaces, which represents an earlier stage of manufacture. Blade and stem edges have had their shape regularised by fine, intermittent retouch. Specimens have been identified as being manufactured on Onondaga, Fossil Hill, Gull River, Kettle Point and other exotic chert. In general, the range is southern Ontario, extending from modern southern Lake Huron in the west, around the margins of the Simcoe Lowlands, and to the Peterborough-Rice Lake area in the east. The majority of the complete specimens have been found in the central Simcoe Lowlands area from the Coates Creek-Hussey site area in the west, to the area near Kirkfield in the east.

Madina-like projectile points have been reported from the Alton site in Indiana. The proximal ends of a number of contracting stemmed points from Alton are illustrated in Tomak (1994: Figure 7.5–Top Row), in addition to a slightly notched projectile point (Figure 5.5, Row 2.3) that is similar to specimens found at Coates Creek (Storck 1978b) and van Mil (Jackson 1979). An end scraper from the Alton site (Tomak 1994: Figure 7.6:2) is similar to one (7Yk7.4) found at the Draper site and is illustrated in Figure 5.12:9 of this report. There is a notable similarity in style of most of the major artifact types (with the primary exception being the change from fluted to contracting stemmed projectile points). This suggests that the Late Palaeo-Indian Madina peoples were possibly either direct descendants and/or very closely related to the Early Palaeo-Indian groups who occupied the margins of the former Lake Simcoe-Georgian Bay lowlands, either at the time or shortly after, Lake Algonquin began to drain. The fact that Fossil Hill chert is still dominant within the lithic assemblage at the Deavitt site and within its immediate environs, suggests that the same quarries were still in use. Small sites such as Draper, Boyington and Cowieson-Fenton, were probably occupied contemporaneous with the large Deavitt base camp. These encampments were likely associated with either hunting and/or the field processing of game. Isolated artifacts made of "fossil raw materials" were found at smaller sites like Fossil Hill, Gull River or Balsam Lake. These may represent field stations where artifacts were refurbished, or they could be indications of the presence of larger sites as yet unrecognised as such (Figures 5.2 and 5.17).

The black chert adze fragment (possibly made from chunnel coal) that was found at the Boyington site (Figure 5.9) is similar in style to chert adzes that were found at the Late Palaeo-Indian – Early Archaic Dalton complex in the American southeast. The artifacts date to ca. 10,500 to 9,290 B.P. at Rodgers Shelter and Graham Cave in Missouri, respectively (Morse 1979:135). Hi-Lo projectile points, like the one from the Draper Hi-Lo (7Yk41.2) site (Figure 5.7:5), are similar in style to those recovered from Dalton complex sites (Ellis and Deller 1982:16–17). The exotic chert projectile base from the Deavitt site (7Yk10.1342) is made of raw material, which is similar to that used at the Late Palaeo-Indian Reagan site in Vermont. The pentagonal quartz projectile point from the Lewis (7Yk4) site is similar in style to projectile points recovered from the Plenge site in New Jersey (Kraft 1973). This presence of exotic artifact styles and lithic materials suggests that there was interaction during the Early Holocene Late Palaeo-Indian period, between peoples in southern Ontario and throughout other areas of both the northeastern and southeastern United States.

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6.

Fowler Site: a Holcombe Camp Near Lake Simcoe, Ontario

Philip J.Woodley

Abstract

Excavated entirely with 3-mm mesh screen, the Fowler site represents the only single component Late Palaeo-Indian Holcombe camp excavated in southern Ontario. It is located on a relict beach ridge overlooking the later Algonquin/Ardtrea glacial shoreline. The Fowler assemblage is similar in many ways to those from Early Palaeo-Indian sites, including the recovery of *pièce esquillée*, a fluted scraper, gravers, narrow end scrapers, channel flakes and projectile points fluted on only one face. Fowler is interpreted as a single occupation Holcombe site, situated at a narrows in a glacial lake ideally situated to intercept caribou migration. Alternatively, Fowler was situated in such a locale because lowering lake levels left a swampland and associated resources for extraction.

Résumé

Le gisement Fowler se situe sur une plage ancienne qui donne sur le rivage du lac glaciaire Algonquin/Ardtrea. Excavé complètement utilisant un écran de 3 mm de largeur, Fowler est le seul campement Paléoindien Holcombe à composant simple excavé en Ontario du sud. L'assemblage à Fowler se ressemble en plusieurs égards à celles-lui des sites Paléoindiens anciens, y compris une *pièce esquillée*, un grattoir cannelé, des gravoirs, des grattoirs transverses étroits, des éclats de flute et des points de projectile cannelés sur une face seulement. L'assemblage suggére que le Holcombe se ressemble aux sites Paléoindiens anciens plus qu'aux sites Paleoindiens supérieurs. On interpréte le site Fowler comme un occupation Holcombe simple, situé près d'un détroit dans un lac glaciaire, et situé idéalement pour intercepter la migration des caribous. C'est aussi possible que Fowler se situe dans un tel lieu parceque le dénivellation du lac a laissé un marais et les ressources associées.

The Late Palaeo-Indian Great Lakes: Geological and Archaeological Investigations of Late Pleistocene and Early Holocene Environments. Edited by Lawrence J. Jackson and Andrew Hinshelwood. Mercury Series, Archaeology Paper 165. Canadian Museum of Civilization. Gatineau, Quebec, 2004.

Introduction

This report discusses the excavation and interpretation of the Fowler site located near Barrie, southcentral Ontario. Fowler is a single component Palaeo-Indian site located on a relict beach overlooking the Algonquin (Ardtrea) glacial lake. The projectile points and artifact assemblage are similar to those from the Holcombe site (Fitting, DeVisscher and Wahla 1966). A ghost feature was excavated by piece-plotting the artifact distribution in the subsoil. This report will examine the artifacts from Fowler and their spatial distribution, and attempt to incorporate this information into the Palaeo-Indian cultural milieu. Given that this is the only single component Holcombe site excavated in southern Ontario, it will be discussed in detail. Fowler was excavated in June of 1998 as part of a CRM project.

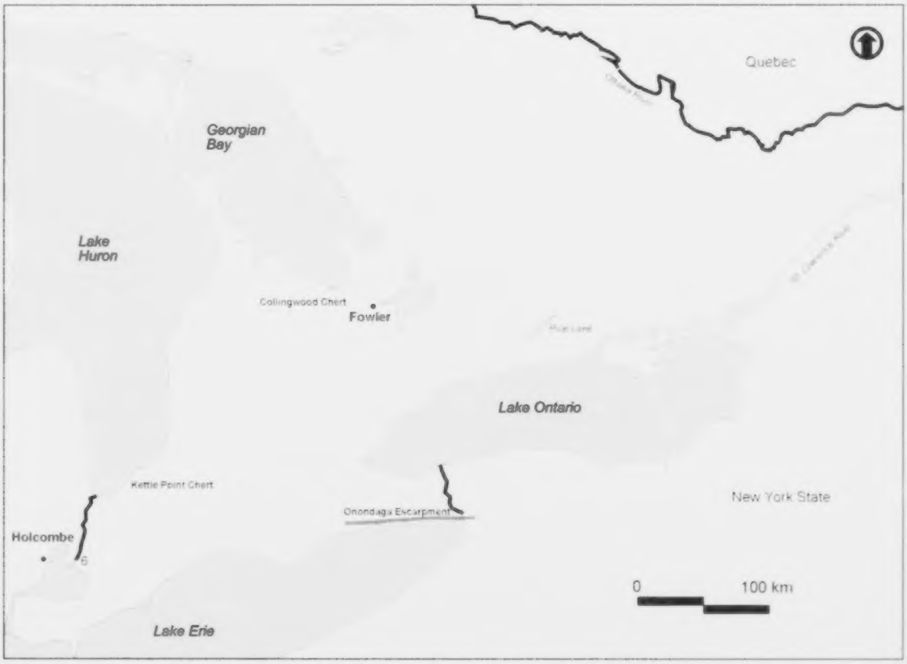

Quebec
Georgian Bay
Lake Huron
Collingwood Chert
Fowler
Lake Ontario
Kettle Point Chert
Onondaga Escarpment
New York State
Holcombe
6
0
100 km
Lake Erie

Figure 6.1 Map of Southern Ontario Chert Sources and the Location of Fowler and Holcombe Sites.

Location

Fowler was found in a cultivated field west of the City of Barrie, Simcoe County, southern Ontario (Figure 6.1, Figure 6.2). It is located on a relict glacial beach on the west side of a small stream, which flows northward into a cedar swamp.

The study area, located in the Simcoe Lowlands physiographic region (Chapman and Putnam 1984:177–182), which borders Lake Simcoe and extends to Georgian Bay, was

Figure 6.2 Excavation of Fowler.

flooded during the higher stages of glacial Lake Algonquin (Chapman and Putnam 1984:181). Kempenfelt Bay, located on the west side of Lake Simcoe, extended westward during times of higher glacial lakes, with numerous shorelines leading to a series of swamp and bog areas (Chapman and Putnam 1984:181). The study area, which is located on the south side of the Kempenfelt valley, has a series of relict beach shorelines leading to a less elevated, swampy area. The soil is comprised primarily of sandy topsoil or ploughzone with packed sand subsoil. Given the ploughed nature of this field, the upper soil horizons have been mixed together through recent mechanical means.

Field Methodology

A five-metre grid was established over Fowler. Each five-metre square was divided into 25 one-metre sub-squares with each excavated unit identified by the easting and northing coordinate of its southwest corner. The ploughzone from each square was shoveled into a 3-mm mesh screen to recover all artifacts. After the ploughzone was completely excavated, the bottom of each square was troweled and the subsoil examined for features and/or post moulds. The subsoil was excavated in arbitrary 5-cm levels to recover artifacts and also, in an attempt to identify subsoil features.

Given the small mesh being used for excavation, a field count of less than 10 artifacts per one-metre square was used, as an arbitrary cutoff point for determining if adjoining squares required excavation. A total of 170 one-metre squares were excavated, indicating an overall site size of 12 by 17 metres.

Raw Material

The assemblage from Fowler contained five different raw materials. The majority of artifacts are of Onondaga chert, which is generally obtained from south of the Onondaga Escarpment and north of Lake Erie (Figure 1; Eley and von Bitter 1989:17). Significantly fewer artifacts of Collingwood chert, also known as Fossil Hill chert, were recovered, the source of which is in the Collingwood area at the south end of Georgian Bay (Figure 1; Eley and von Bitter 1989:22). A few flakes and tools of Kettle Point chert, normally found on the southeast shore of Lake Huron, were also recovered (Figure 1; Eley and von Bitter 1989), in addition to a possible chopping tool and a few flakes of quartzite, the source of which is unknown. Finally, a number of spalls, chunks, and a possible chopping tool made of greywacke were found. Greywacke is a green silicious material that is found in glacial deposits throughout southern Ontario (Kenyon 1980).

Subsoil Feature

One subsoil feature was found during the excavation of Fowler (Figure 6.3). There was no soil staining evident and it was identified only by the distribution of artifacts in the subsoil (Figure 6.4). For lack of a better term, this will be called a "ghost feature". Presumably the colour had leached out of the feature soil, leaving only the artifacts to indicate feature size and location. Feature 1 was trowel excavated in arbitrary 5-cm levels in 50-cm quadrants (Figure 6.5), and the location of all artifacts was plotted on graph paper, using their XY coordinates. This information was loaded onto a computer to produce artifact distribution maps, which assisted in determining the overall size of Feature 1 (Figure 6.4).

Feature 1 was located near the centre of the excavated area and oriented along a northeast-southwest axis, with dimensions of 4.00 metres long, 1.65 metres wide, 0.30 metres deep (Figures 6.3 and 6.4). It contained 667 pieces of debitage or 32% of the entire debitage sample and, of this material, 556 pieces of debitage were of Onondaga chert and 111, of Collingwood chert. Also recovered were 108 greywacke spalls, or approximately 50% of the entire greywacke assemblage from this site. The feature also contained one graver, one scraper fragment, and one projectile point. The projectile point is burnt but the matching heat spalls were recovered from the same vicinity in the feature, which suggests that this was caused by post-depositional heating. These artifacts will be discussed in detail later in this report. Some small charcoal fragments were also recovered from soil samples processed through a flotation device.

AMS Radiocarbon Dating

One 0.29-gram sample, identified as coniferous wood charcoal (G. Crawford, personal communication 2001), was submitted to Isotrace Laboratories, University of Toronto, for an AMS radiocarbon date. The results of this analysis provided a date of 520+- 90 years B.P. (Isotrace Lab Number TO-9334). This date is too recent for the Palaeo-Indian occupation of the Fowler site, indicating that the charcoal was intrusive in Feature 1. This is consistent with the burnt projectile point recovered from the feature.

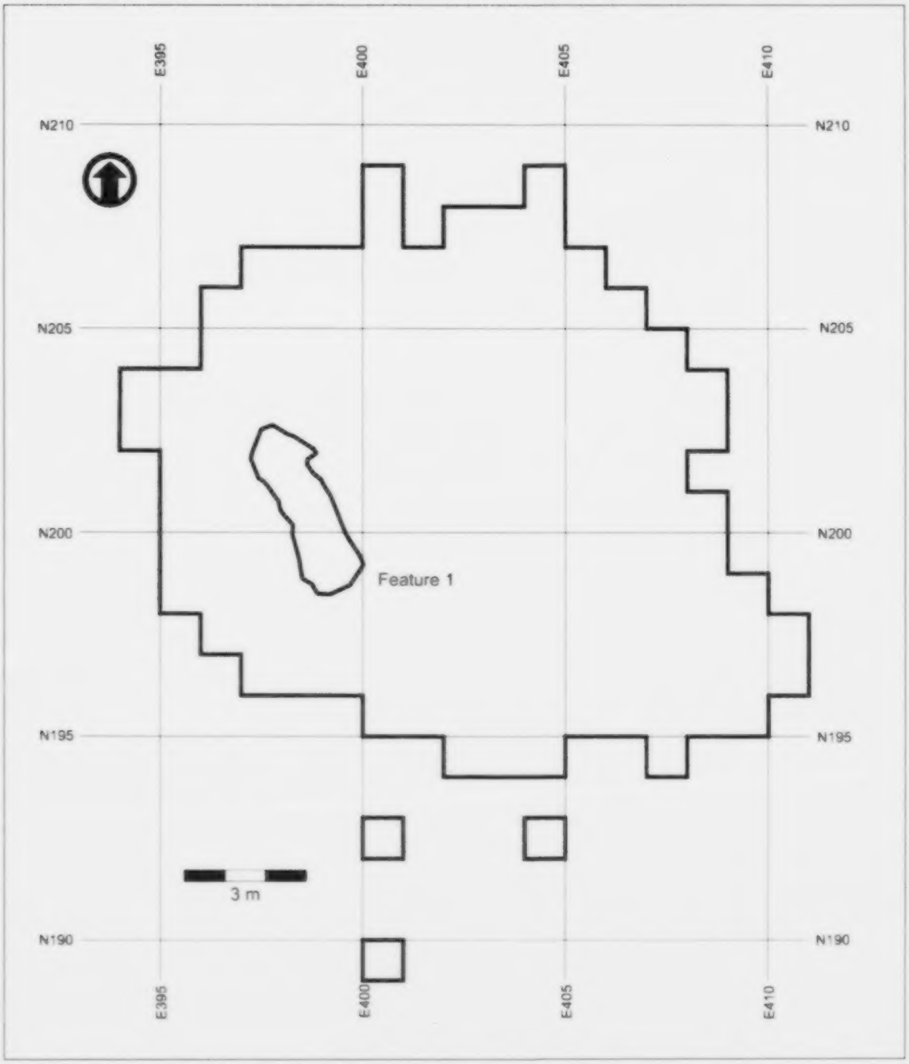

E395
E400
E405
E410
N210
N205
N200
N195
N190
Feature 1
3 m

Figure 6.3 Edge of Excavation and Location of Feature 1.

Artifact Aalysis

Debitage

A total of 2,105 pieces of debitage with a combined weight of 187.41 grams were recovered from Fowler. For analytical purposes, the debitage was divided into the following types: shatter, decortication, primary, bipolar, bifacial thinning, edge trimming, platform rejuvenation,

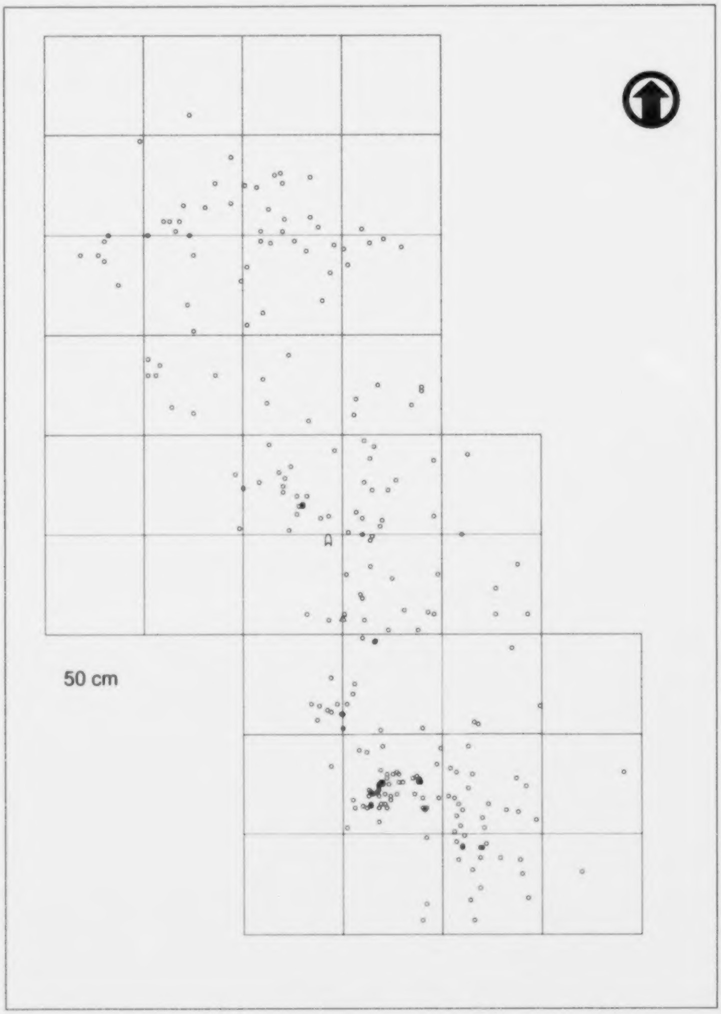


Figure 6.4 Piece Plot Distribution Plan of Feature 1.

scraper retouch, channel and fragments. These flake types represent fairly distinct stages in the reduction sequence. To ensure that each flake was not counted twice, only those with a striking platform were typed and those without classified as fragments. Only the flake types recovered from Fowler are included in Table 6.1. Because 3-mm mesh screen was used, many of the flakes are very small. To obtain a better idea of overall flake size, the debitage was weighed to .01 of a gram.

To summarize Table 6.1 by frequency, over 87% of the debitage is of Onondaga chert, 12% of Collingwood and the remainder is comprised of a few flakes of Kettle Point chert and

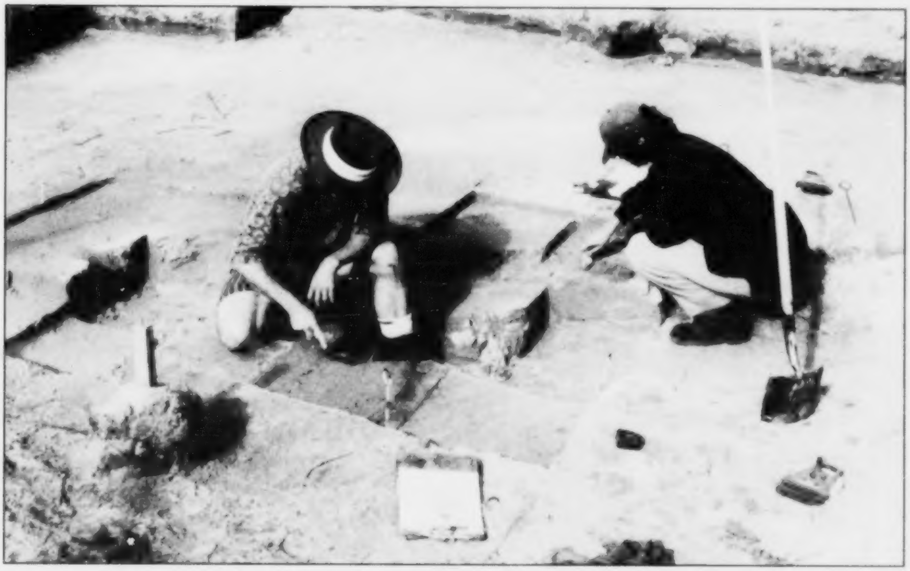


Figure 6.5 Trowel Excavation of Feature 1.

quartzite. The flake frequency percentages indicate that a high percentage of biface edge trimming flakes and scraper retouch flakes were recovered, while flake fragments account for over 50% of the debitage. These overall frequencies are comparable to the debitage from Feature 1, from which one decortication flake, 73 biface thinning, 120 edge trimming, 435 fragments, seven shatter, four platform preparation, and 27 scraper retouch flakes were recovered. The weight percentages of debitage from Fowler (in bold in Table 6.1) are similar to those for frequency. By weight, the larger flakes (e.g., biface thinning) have the highest percentage, followed by fragments, edge trimming and scraper retouch flakes.

The frequency distribution of total debitage per one-metre square is presented in Figure 6.6 and total weight in Figure 6.7. Debitage frequency per one-meter square ranges from 0 to 86 and weight from 0 to 13.9 grams. The coded debitage frequency distribution is presented in Figure 6.8. In an attempt to discern whether the different chert types were being used during discrete occupations, the distribution of Collingwood chert was mapped (Figure 6.9); however, the Collingwood chert distribution closely mirrors the overall flake distribution (Figures 6.6 and 6.8). The topsoil distribution of scraper retouch flakes is presented in Figure 6.10. These debitage distribution figures all indicate that the Palaeo-Indian occupation at Fowler is 12 x 17 metres in size. It is notable that each of these figures indicates a number of higher frequency areas; this distribution pattern will be discussed in more detail later in this report.

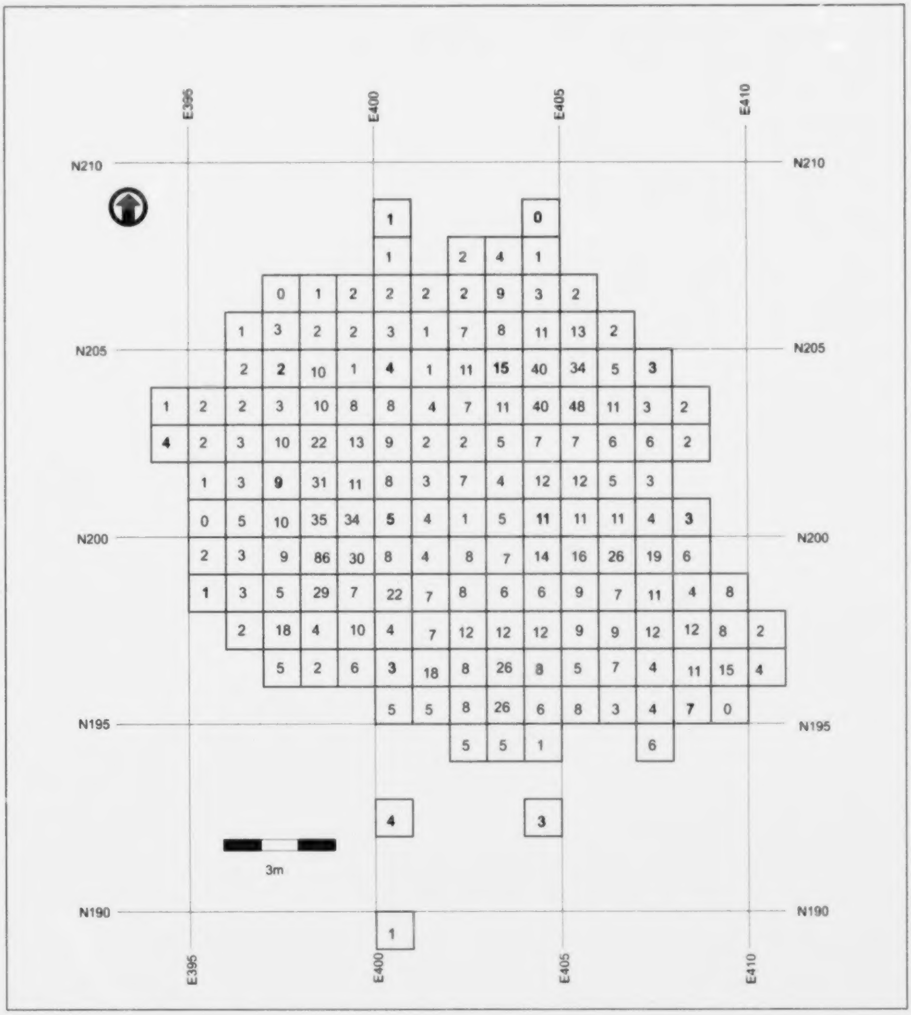
The use of 3-mm mesh screen during excavation resulted in the recovery of a high percentage of very small pieces of debitage. For comparative purposes during analysis the debitage was screened through 6-mm mesh screen. The results of this process are provided in Table 6.1, where the frequency of material that would have been recovered using 6-mm mesh screen is presented in italics. Clearly, the debitage frequency of 6-mm mesh screen is much

Table 6.1 Debitage flake type, frequency, weight (bold) and 6 mm frequency (italics) by material type.

Flake Type	Onondaga	Collingwood	Kettle Point	Quartzite	Total	Percentage
DECORTICATION	–	4 **6.33 g** *4*	–	–	4 **6.33 g** *4*	0.2% **3.4%** *0.7%*
PRIMARY	5 **5.77 g** *5*	2 **2.83 g** *2*	–	–	7 **8.60 g** *7*	0.3% **4.6%** *1.2%*
BIFACE THINNING	243 **65.77 g** *225*	25 **4.19 g** *24*	–	–	268 **69.96 g** *249*	12.7% **37.3%** *41.3%*
EDGE TRIMMING	515 **17.96 g** *68*	58 **1.46 g** *0*	–	1 **0.03 g** *0*	574 **19.45 g** *68*	27.3% **10.4%** *41.3%*
FRAGMENT	968 **56.69 g** *204*	160 **10.85 g** *40*	1 **0.28 g** *1*	–	1129 **67.82 g** *245*	53.6% **36.2%** *40.6%*
SHATTER	3 **5.97 g** *2*	–	–	–	3 **5.97 g** *2*	0.1% **3.2%** *0.3%*
PLATFORM PREPARATION	4 **0.32 g** *3*	1 **0.13 g** *0*	–	–	5 **0.45 g** *3*	0.2% **0.2%** *.05%*

Table 6.1 continues

Flake Type	Onondaga	Collingwood	Kettle Point	Quartzite	Total	Percentage
SCRAPER RETOUCH	95	16	–	–	111	5.3%
	5.66 g	**1.4 g**			**7.06 g**	**3.8%**
	20	*3*			*23*	*3.8%*
POTLIDS	2	–	–	–	2	0.1%
	0.03 g				**0.03 g**	**–**
	0				*0*	–
UNKNOWN	–	–	–	2	2	0.1%
				1.74 g	**1.74 g**	**0.9%**
				2	*2*	*0.3%*
TOTAL	1835	266	1	3	2105	99.9%
	158.17 g	**27.19 g**	**0.28 g**	**1.77 g**	**187.41 g**	**100%**
	527	*73*	*1*	*2*	*603*	*100%*
PERCENTAGE	87.2%	12.6%	0.0%	0.1%	99.9%	
	84.4%	**14.5%**	**0.1%**	**0.9%**	**99.9%**	
	87.4%	*12.1%*	*0.2%*	*0.3%*	*100%*	


E395
E400
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N200
N195
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1 0
1 2 4 1
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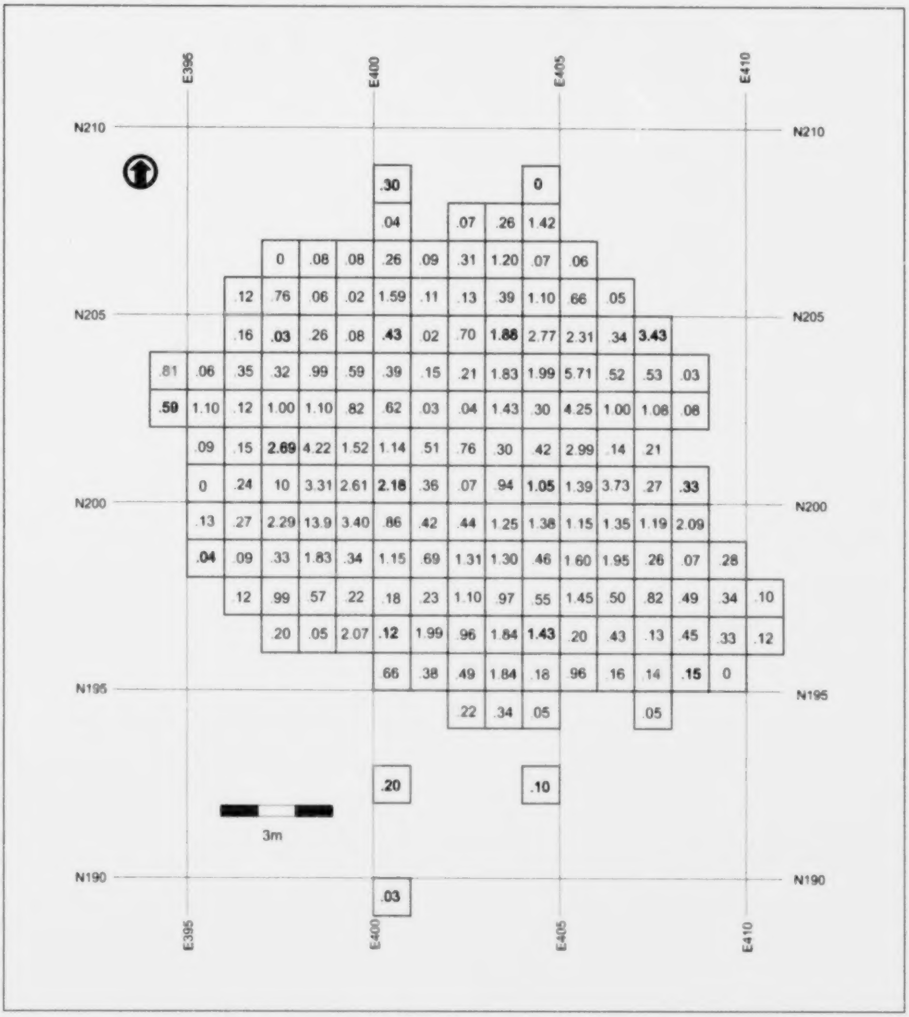
1 3 2 2 3 1 7 8 11 13 2
2 2 10 1 4 1 11 15 40 34 5 3
1 2 2 3 10 8 8 4 7 11 40 48 11 3 2
4 2 3 10 22 13 9 2 2 5 7 7 6 6 2
1 3 9 31 11 8 3 7 4 12 12 5 3
0 5 10 35 34 5 4 1 5 11 11 11 4 3
2 3 9 86 30 8 4 8 7 14 16 26 19 6
1 3 5 29 7 22 7 8 6 6 9 7 11 4 8
2 18 4 10 4 7 12 12 12 9 9 12 12 8 2
5 2 6 3 18 8 26 8 5 7 4 11 15 4
5 5 8 26 6 8 3 4 7 0
5 5 1 6
4 3
1
3m

Figure 6.6 Debitage Frequency by one Metre Square (3 mm mesh).

lower – only 603 pieces of debitage or 28% of the total number would have been recovered if the larger mesh screen were used during excavation. The chert type percentages remain comparable regardless of the size of mesh used, indicating that flake sizes are comparable between materials. The frequency percentage of biface thinning flakes would increase from 13% to 41% of the debitage assemblage, and the frequency of edge trimming flakes would increase from 27% to 41%. Decortication and primary flakes remain about the same, while the percentage of scraper retouch flakes is slightly lower. Flake fragments decrease from 54%


E395
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E405
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N200
N195
N190
.30 0
.04 .07 .26 1.42
0 .08 .08 .26 .09 .31 1.20 .07 .06
.12 .76 .06 .02 1.59 .11 .13 .39 1.10 .66 .05
.16 .03 .26 .08 .43 .02 .70 1.88 2.77 2.31 .34 3.43
.81 .06 .35 .32 .99 .59 .39 .15 .21 1.83 1.99 5.71 .52 .53 .03
.59 1.10 .12 1.00 1.10 .82 .62 .03 .04 1.43 .30 4.25 1.00 1.08 .08
.09 .15 2.69 4.22 1.52 1.14 .51 .76 .30 .42 2.99 .14 .21
0 .24 10 3.31 2.61 2.18 .36 .07 .94 1.05 1.39 3.73 .27 .33
.13 .27 2.29 13.9 3.40 .86 .42 .44 1.25 1.38 1.15 1.35 1.19 2.09
.04 .09 .33 1.83 .34 1.15 .69 1.31 1.30 .46 1.60 1.95 .26 .07 .28
.12 .99 .57 .22 .18 .23 1.10 .97 .55 1.45 .50 .82 .49 .34 .10
.20 .05 2.07 .12 1.99 .96 1.84 1.43 .20 .43 .13 .45 .33 .12
.66 .38 .49 1.84 .18 .96 .16 .14 .15 0
.22 .34 .05 .05
.20 .10
.03
3m

Figure 6.7 Total Debitage Weight (to 0.01 gram) by one Metre Square.

to 40% when 3-mm mesh screen is changed to 6-mm mesh screen, and this confirms that a very high percentage of the debitage from Fowler is very small. Given the very small size of the debitage that was removed from the sample after employing the 6-mm mesh screen, the weight was not recalculated since it would not have varied significantly. The debitage frequency by one-metre square, if 6-mm mesh screen was used, is presented in Figure 6.11. Debitage frequency would have ranged from 0-44 flakes per one-metre square (Figure 6.11).

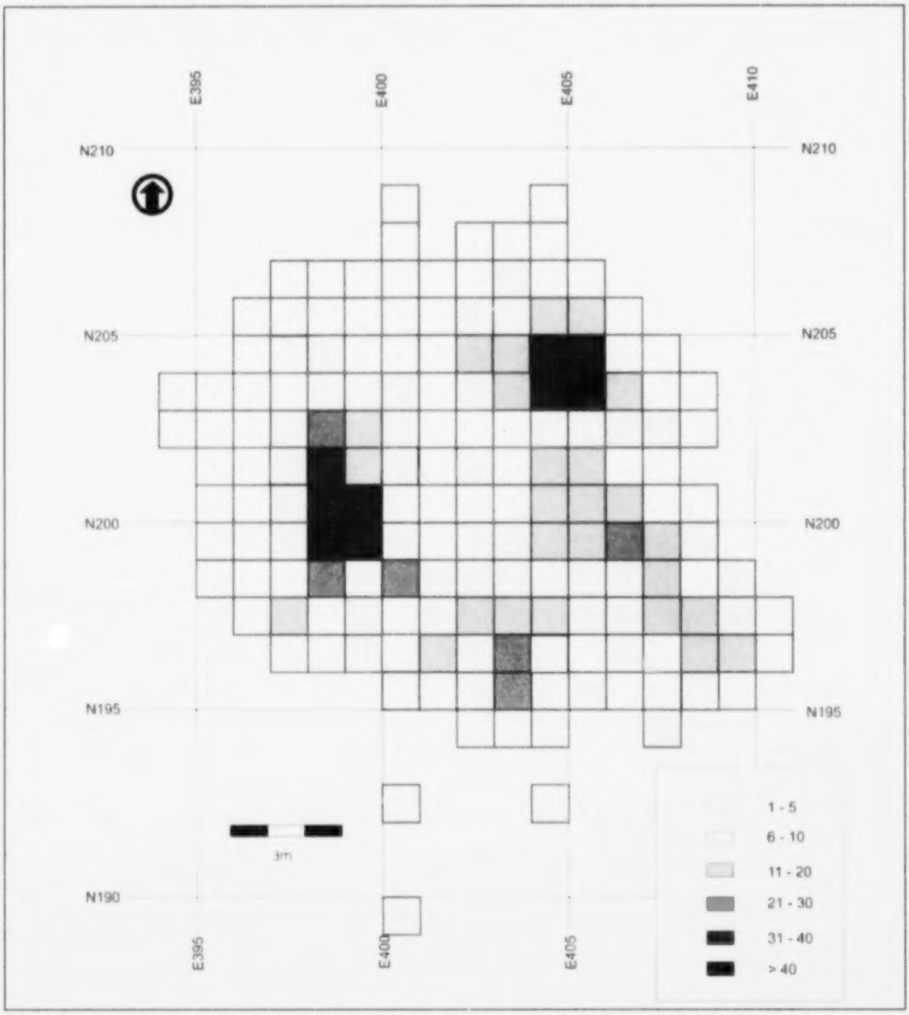


Figure 6.8 Coded Debitage Frequency by one Metre Square (3 mm mesh).

Greywacke

A total of 245 greywacke waste flakes weighing 260.23 grams were recovered. This material is not included in the debitage table because it was not used to manufacture formal chipped lithic tools but rather large, coarse chopping tools (e.g. Figure 6.12). Given that the fracture planes of greywacke differ significantly from chert, this material was simply counted and weighed. The distribution of greywacke from the ploughzone excavation is presented in Figure 6.13. Greywacke frequency ranges from zero (for most squares) to a high of 31 directly

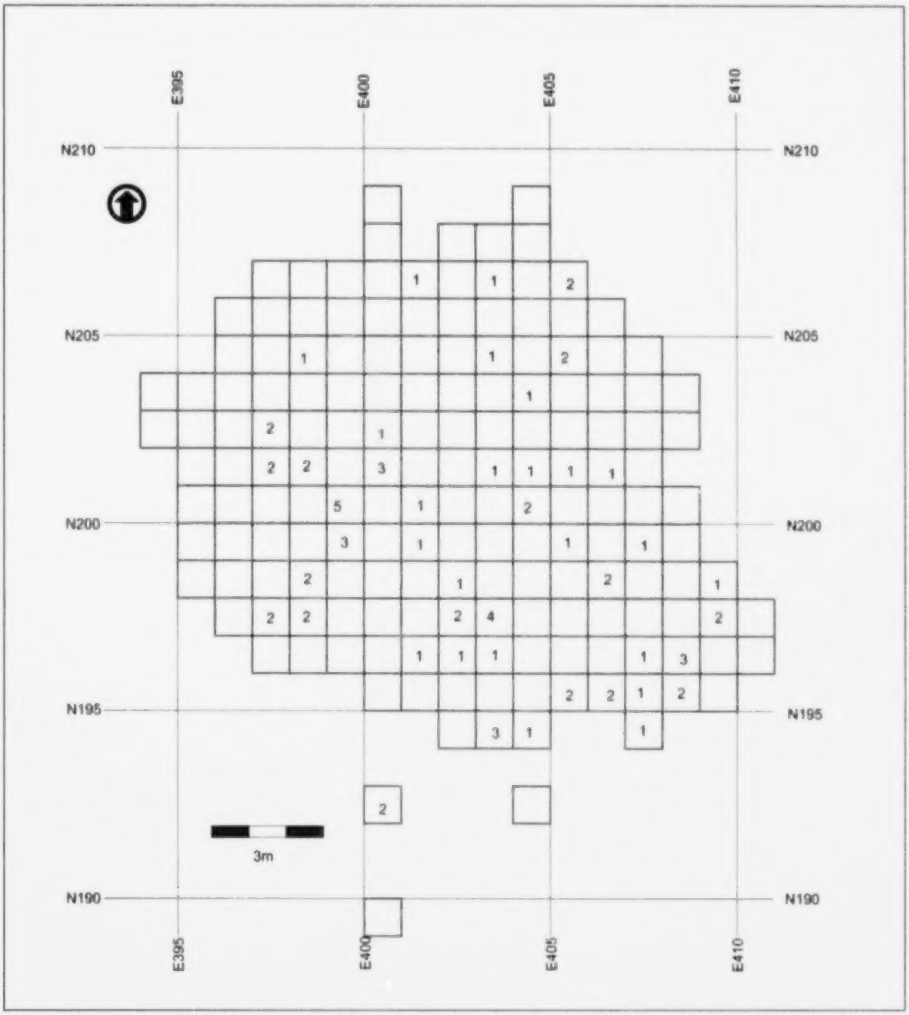
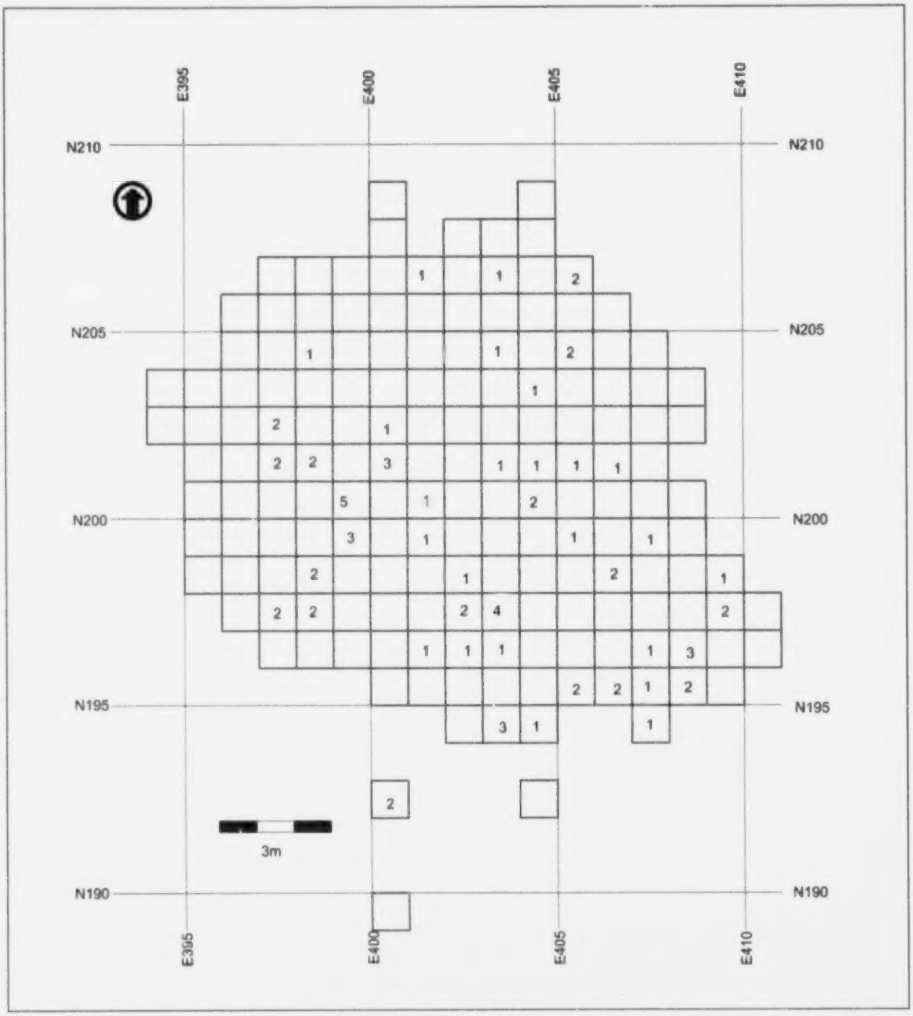


Figure 6.9 Collingwood Chert Debitage Distribution by one Metre Square.

over Feature 1. This distribution roughly mirrors the topsoil distribution of debitage (Figures 6.7 and 6.8). Of the 245 greywacke spalls recovered from Fowler, 108 or, 44% of the sample came from Feature 1. For comparative purposes, if 6-mm mesh screen had been used for the excavation, only 143 greywacke spalls would have been recovered from the site.

Five large chunks of greywacke were recovered, which are described in Table 6.2, and their distribution shown in Figure 6.14. All of these chunks have at least one face of the original exterior remaining intact, with the remainder of each the result of the removal of large flakes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2
N195
N195
3
1
1
2
3m
N190
N190
E395
E400
E405
E410

Figure 6.10 Scraper Retouch Flake Frequency Distribution by one Metre Square.

or spalls. It has been determined that these flakes were not recently removed – the old spall scars are lighter, indicative of long term weathering, while the exposed surface of recent flake scars (presumably caused by recent cultivation) are dark green. Given that such a large percentage of the greywacke sample was recovered from Feature 1, it is evident that the greywacke chunks were worked during the prehistoric occupation at Fowler. Of these larger chunks, one is a possible chopping tool (see Figure 6.12b) and one, a possible grinding tool; the remainder (e.g. Figure 6.12a,c) is only modified rock.

It appears that some of the larger greywacke spalls were used as tools. One was recovered

Table 6.2 Greywacke Chunks and Possible Tools.

Unit	Length (mm)	Width (mm)	Thick. (mm)	Weight (g)	Comment
E403N202	97.1	76.5	43.7	449.7	Lots of cortex; some recent spalls
E403N203	120.6	76.3	41.3	396.1	Some cortex, plano convex in cross-section, flakes removed suggest a chopping tool
E400N198	94.1	73.0	44.1	383.8	Some cortex, lots of large flake spalls
E401N198	89.1	84.3	17.4	136.1	Large spall, cortex on one side
E401N198	92.7	72.5	62.8	550.9	Cortex on one side, smoothed on the other
Mean	98.7	76.5	41.9	383.3	

from unit E398:N199 (Figure 6.14) and appears to have been used as a scraper. It is a large flake, 40.1-mm long, 45.2-mm wide, and 8.0 mm thick with pronounced curvature from the proximal to the distal end. It has wear on the distal end that is convex and 27-mm long. This suggests that some of the greywacke chunks were simply a source for raw material rather than the chunks themselves being used as a tool.

Hammerstones/Chopping Tools

Two possible hammerstones of igneous rock (Figure 6.14) were recovered from Fowler. The first, from Feature 1, is oval, weighing 320.6 grams, and with dimensions measuring 92.0 mm long, 54.9 mm wide, and 38.8 mm thick. It has only a hint of wear on one end. The second possible hammerstone is from square E403N202. It is broken but much larger, weighing over 600 grams, with dimensions of 73.5+ mm long, 101.8 mm wide, 61.5 mm thick. Similar to the first hammerstone, there is not a lot of convincing wear on this possible tool.

Finally, a possible quartzite chopping tool was recovered from unit E399N199 (Figure 6.14). It is 68.6 mm long, 55.7 mm wide, 21.8 mm thick and weighs 82.5 grams. One end is convex and similar in shape to a large scraper. Given that use-wear is difficult to discern on quartzite, it is unknown if this specimen is natural or cultural.

Fire-cracked Rock

Two fire-cracked rocks were recovered from the ploughzone on the west edge of the excavation (Figure 6.14), close to Feature 1. One weighing 309.9 grams was recovered from unit E395:N200, and the second, weighing 51.0 grams, was recovered from unit E396:N200. If rocks were being used extensively for cooking then one would expect to see far more of this material recovered.

Channel Flakes

Three Onondaga chert channel flakes were recovered from Fowler (Figure 6.15). Given the specialized nature of this flake type and also the low frequency, these flakes have been sepa

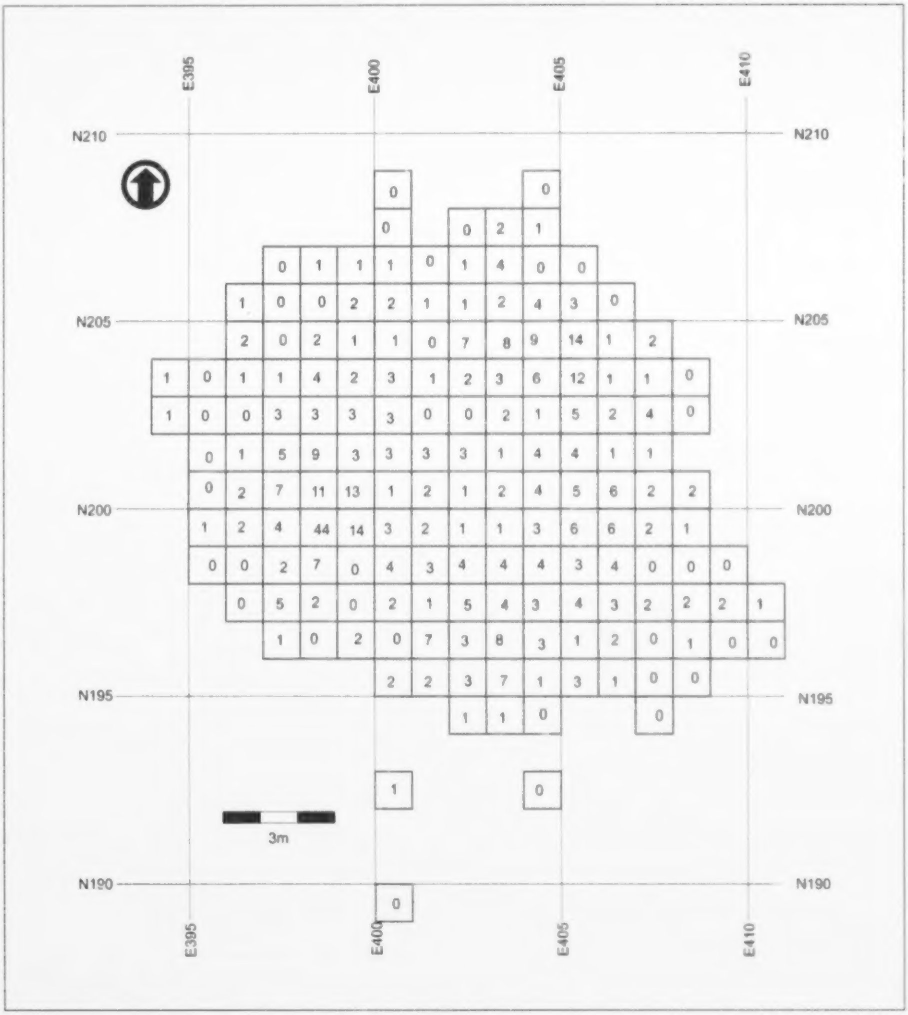


Figure 6.11 Debitage frequency by one metre square (6 mm mesh).

rated from the other debitage and their distribution has been plotted with the tools on Figure 6.16. All three are midsection fragments and they have lateral flake scars on the dorsal surface, perpendicular to the direction the flakes were removed. There is some variation in the width and thickness of these specimens. One flake (E401N197) is 10.6 mm wide and 1.5 mm thick, the second (E396N201) is 8.3 mm wide and 1.2 mm thick, and the third (E407N196) is 7.9 mm wide and 1.1 mm thick, for a mean width of 8.93 mm and a mean thickness of 1.27 mm. None of these channel flakes were removed from the projectile points recovered from this site.

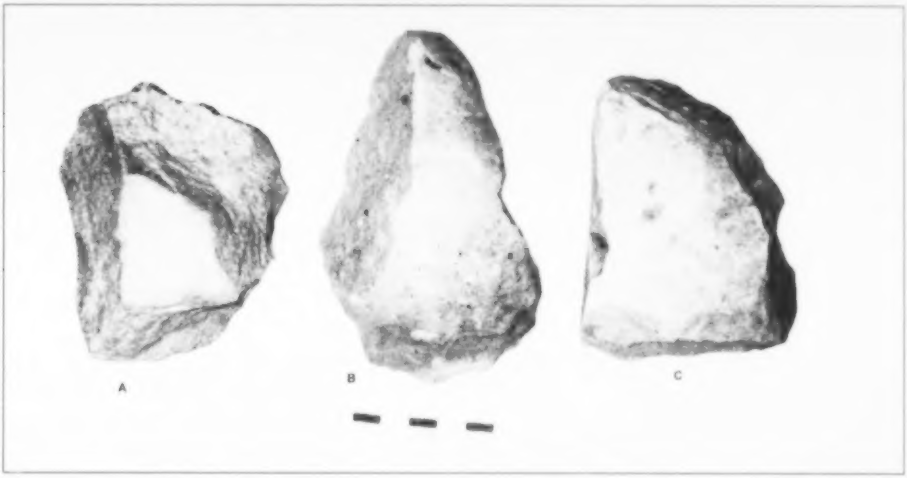


Figure 6.12 Greywacke chunks.

Utilized Flakes

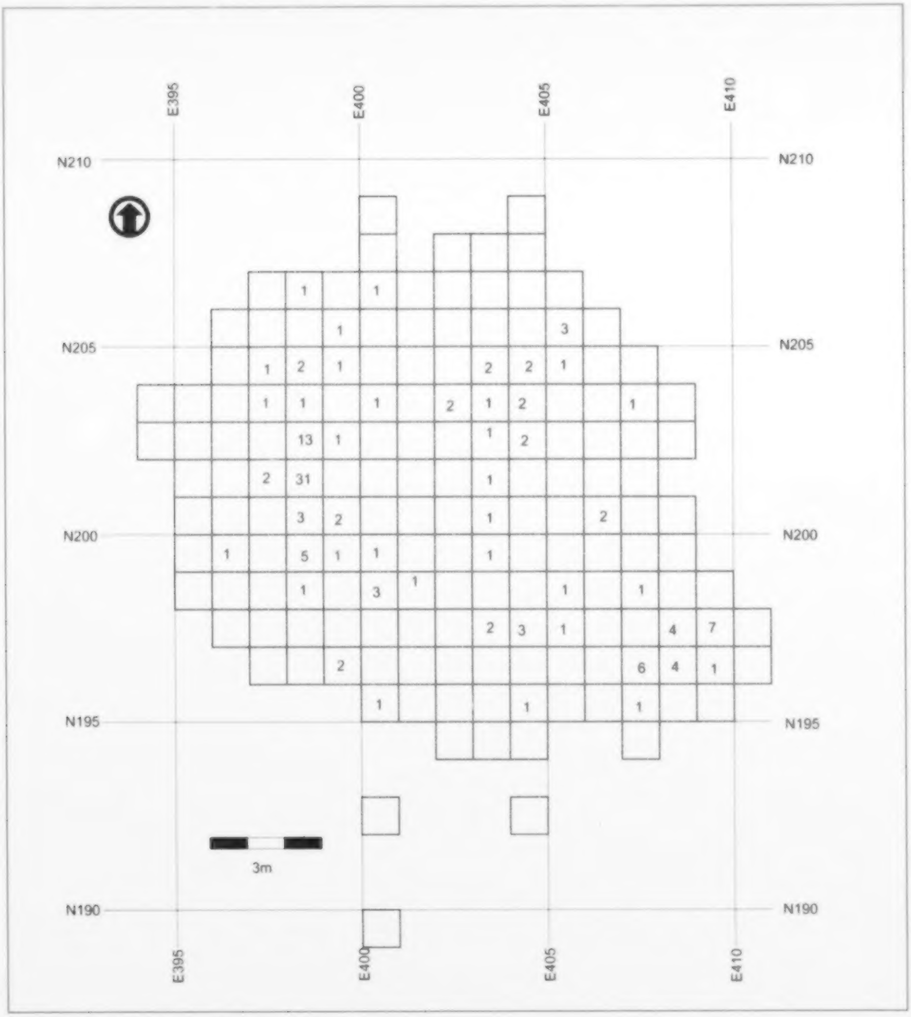
Eight utilized flakes were recovered from Fowler and all were identified macroscopically. These are described in Table 6.3 and their distribution is indicated on Figure 6.16. None of these utilized flakes have been identified as specific tool types (e.g., scrapers) and they are inconsistent in overall size, morphology, and wear locations. The degree of wear (less than 1 mm high) indicates that all were simply used once and discarded. A recent article questions the validity of macroscopic identification of utilized flakes and suggests that all should be analyzed under a microscope (Shen 1999). The tools from Fowler have not been analyzed microscopically; and therefore, the results of the analysis should be employed with caution. Given the results of Shen's work (1999), some or, all of the utilized flakes may have been modified by trampling rather than through use.

Unifaces

Eight unifacial tools and fragments were recovered from Fowler (e.g., Figure 6.17a–c). Their distribution is presented in Figure 6.16. Four are complete or nearly so, and four are small edge fragments.

The first uniface (E401N197) (Figure 6.18, Figure 6.17c), made from a large Kettle Point chert biface thinning flake, is 59.8 mm long, 48.9 mm wide, 6.5 mm thick, and weighs 20.1 grams. It is finely worked around almost the entire outside edge. This tool was made from a flake driven from a very large, well made biface that would have been almost 100 mm wide.

Three nearly complete unifaces and one small fragment have been identified as retouched flakes, and all are made from Onondaga chert biface thinning flakes. Deller and Ellis (1992:72) have identified similar tools from Early Palaeo-Indian sites as "raclettes" (Bordes 1972: Figure 5; Frison and Stanford 1982:50). One, from unit E398N199 (Figure 6.16, Figure


E395
E400
E405
E410
N210
N210
1
1
1
3
N205
N205
1
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1
2
2
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1
1
1
2
1
2
1
13
1
1
2
2
31
1
3
2
1
2
N200
N200
1
5
1
1
1
1
3
1
1
1
2
3
1
4
7
2
6
4
1
1
1
1
N195
N195
3m
N190
N190
E395
E400
E405
E410

Figure 6.13 Greywacke debitage frequency distribution by one metre square.

6.17b), is 56.1 mm long, 35.8 mm wide, 6.1 mm thick, and weighs 9.9 grams. It has convex-shaped wear on the dorsal surface of the distal end 25.2 mm long, which suggests use as a scraper. It also has concave-shaped wear on the left lateral surface 26.0 mm wide and 7.0 mm deep, indicating use as a spokeshave. The second retouched flake, from unit E406N204 (Figure 6.16), also has wear in two locations. It is 52.3 mm long, 32.0 mm wide, 5.2 mm thick, and weighs 7.2 grams. The retouch on the right lateral edge is 26.9 mm long and

Table 6.3 Utilized Flakes

Unit	Flake Type	Material	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Surface	Edge	Shape of Wear	Length of Wear (mm)
E398 N198	primary	Onondaga	37.4	19.0	5.7	3.8	dorsal	right lateral	convex	12.8
E407 N195	biface thinning	Kettle Point	37.5	29.3	4.4	4.4	dorsal	left lateral	irregular	13.3
E401 N196	biface thinning	Onondaga	33.4	27.3	3.4	2.0	dorsal	proximal	convex	10.3
E403 N195	biface thinning	Collingwood	25.3+	33.4	4.5	3.6	dorsal	left lateral	straight	19.1
E400 N195	fragment	Onondaga	27.8+	24.8+	5.2	3.3+	dorsal	left lateral	concave	11.2+
E402 N197	primary	Collingwood	21.2+	27.6+	9.8+	4.1+	dorsal	right lateral	straight	11.3+
E403 N197	decortication	Onondaga	26.9	22.2	5.6	3.2	dorsal	proximal	convex	7.8
E402 N198	primary	Collingwood	50.0	26.4	9.0	8.9	dorsal	right lateral	straight	24.7

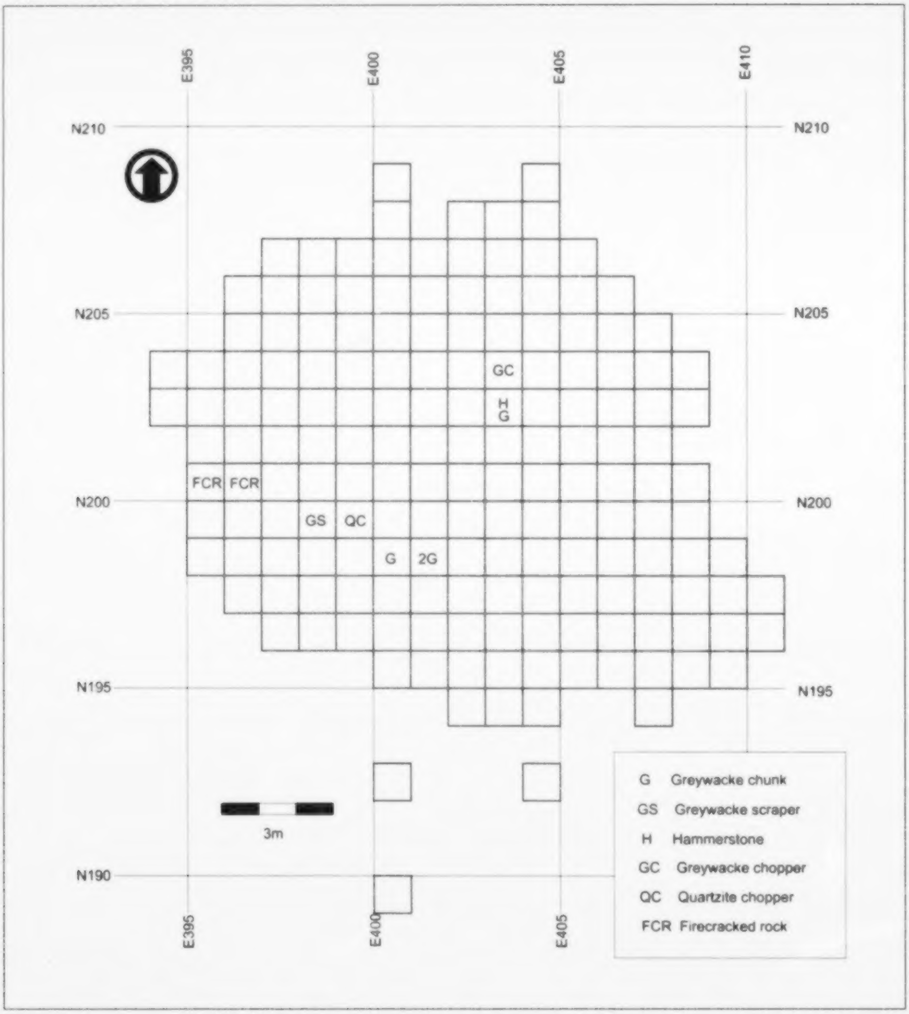

E395
E400
E405
E410
N210
N205
N200
N195
N190
GC
H
G
FCR
FCR
GS
QC
G
2G
3m
G Greywacke chunk
GS Greywacke scraper
H Hammerstone
GC Greywacke chopper
QC Quartzite chopper
FCR Firecracked rock

Figure 6.14 Distribution of Rough Stone Tools and Greywacke Chunks by one Metre Square.

straight. The second edge, which is concave in shape and located on the dorsal surface of the distal edge, is broken so the length measurement is not provided. A third retouched flake was recovered from square E399N199 (Figure 6.16, Figure 6.17a). The distal end is broken, but the remaining fragment is 38.2+ mm long, 23.2+ mm wide, 3.9 mm thick, and weighs 2.6 grams. It has very fine retouch around the entire perimeter. A fourth retouched flake was recovered from E402N204. It is only a small fragment of the original tool but measures 13.4+ mm long, 19.8 mm wide, 2.5 mm thick, and weighs 0.5 grams. It also appears to have been completely retouched around the perimeter.

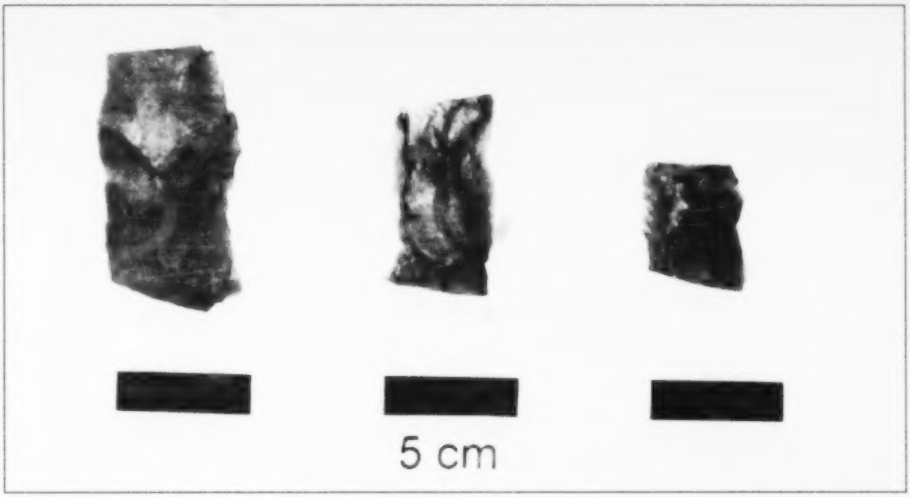


Figure 6.15 Channel flakes.

Three small retouched flake fragments were recovered from Fowler and, because these items were too small to determine if they were raclettes, they have been simply identified as unifaces. Two are made of Collingwood chert, one from E396N205 (Figure 6.16), and the second from Feature 1. The third fragment, from E404N197 (Figure 6.16), is made of Onondaga chert. All three are simply small edge fragments with evidence of retouch, but because of their fragmented state, no further information is provided.

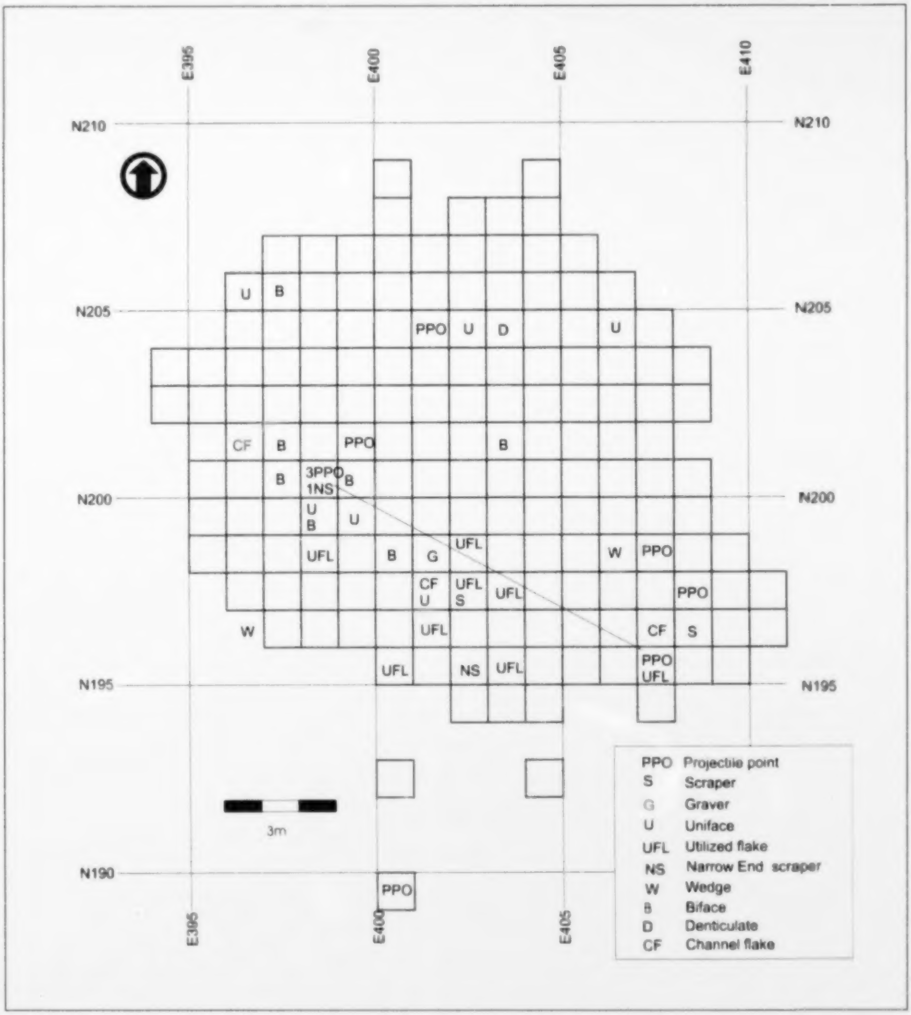
Scrapers

Three scrapers of Collingwood chert were recovered from Fowler. One, from unit E408N196 (Figure 6.16), is a fluted end scraper (Figure 6.17d), with dimensions of 29.5 mm long, 25.0 mm wide, 4.9 mm thick, and weighing 3.5 grams. The wear is concave in shape and located on the distal end. A large flake was removed from the proximal end on the dorsal surface, leading to its identification as a fluted end scraper. One side is broken, but the other side has a small indentation at the midpoint on the other lateral edge, which suggests this tool was hafted.

An edge fragment from a trianguloid end scraper bit fragment was recovered from unit E402N197 (Figure 6.16). The third scraper is a small bit fragment recovered from Feature 1, with a small amount of bifacial working beside the bit, which suggests it was hafted. Given the fragmented nature of these specimens, no measurements are provided.

Narrow End Scrapers

Narrow end scrapers are a distinctive Early Palaeo-Indian tool type (Ellis and Deller 1990:50). A narrow end scraper of Onondaga chert was surface collected from unit E398N200 (Figure 6.16, Figure 6.19a). It is 53.5 mm long with a 20.8 mm long bit, 15.6 mm wide at the base, and 7.8 mm thick. This tool is well made with both lateral edges and the base ground, possibly for hafting.


E395
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B
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3PPO
1NS
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U
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UFL
B
G
UFL
W
PPO
CF
U
UFL
S
UFL
PPO
W
UFL
CF
S
UFL
NS
UFL
PPO
UFL
PPO
3m
PPO Projectile point
S Scraper
G Graver
U Uniface
UFL Utilized flake
NS Narrow End scraper
W Wedge
B Biface
D Denticulate
CF Channel flake

Figure 6.16 Tool Distribution by One Metre Square.

A second narrow end scraper made of Collingwood chert was recovered from unit E402N195 (Figure 6.16, Figure 6.19b, side view). It is made from what appears to be a biface edge fragment, and is 58.3 mm long, 15.2 mm wide, 13.5 mm thick, and weighs 11.8 grams, curving along the ventral surface. The thickness of this tool would have added strength for heavy use. It has small flake scars around the perimeter that indicate it was shaped, but it also has two indentations at about the midpoint, which suggest it was hafted.

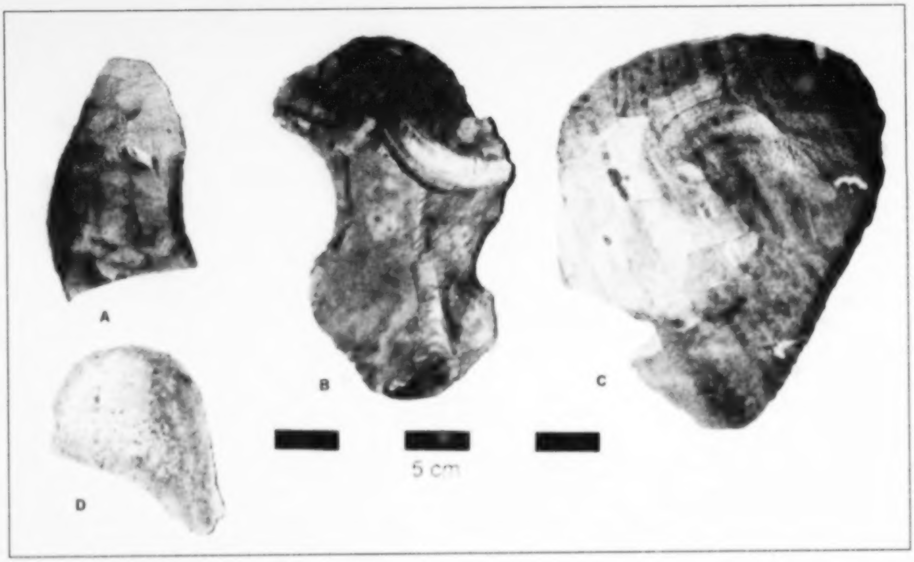

Figure 6.17 Unifaces (A-C) and Scraper (D).

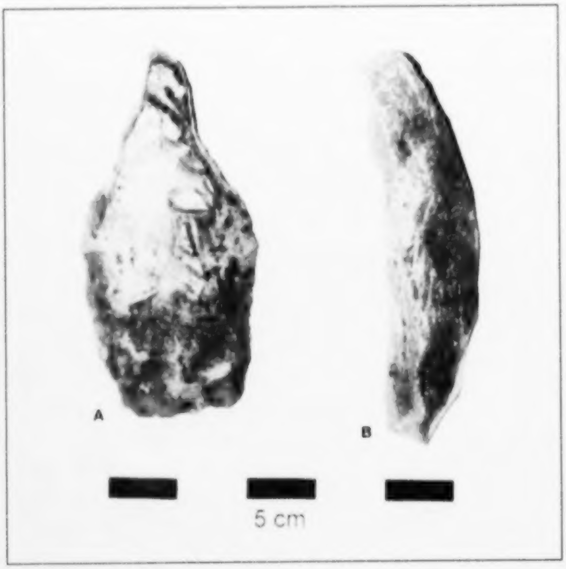

Figure 6.18 Narrow End Scrapers.

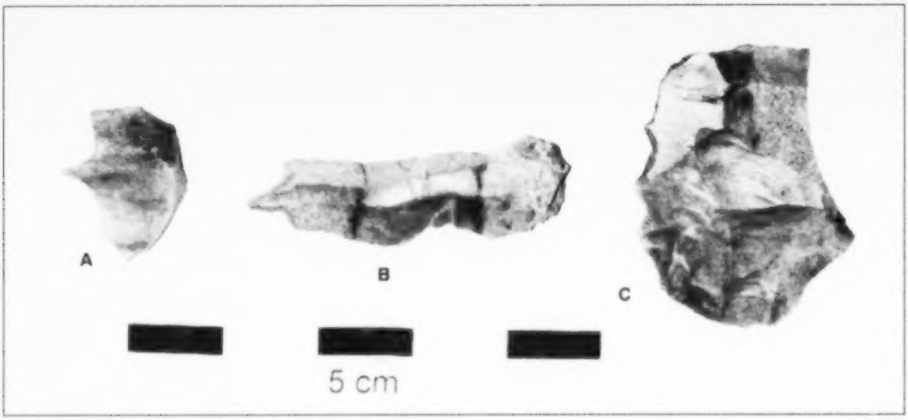

Figure 6.19 Gravers (A-B) and Denticulate (C).

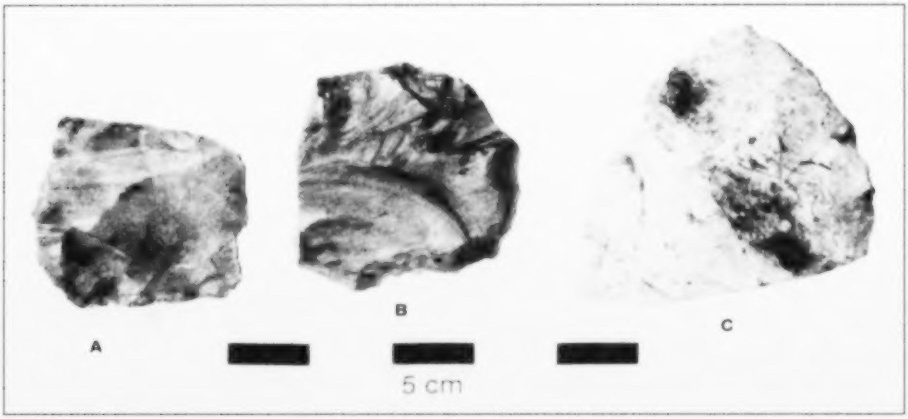

Figure 6.20 Wedges (A-B) and Biface (C).

Gravers

Two gravers were recovered from Fowler. One made of Collingwood chert was recovered from Feature 1 (Figure 6.20a). It is small, made from a flake fragment, and is16.1 mm long, 12.7 mm wide, 3.1 mm thick, and weighs 0.5 grams. The spur is 3.8 mm long and finely worked to a point on both edges. The second graver, recovered from square E401N198 (Figure 6.16, Figure 6.20b), is made from a primary flake of Onondaga chert. It is 34.0 mm long, 10.8 mm wide, 4.8 mm thick, and weighs 1.6 mm. The bit, which is located on the distal end, is 4.3 mm long and finely worked to a point along both edges. The thickness of this tool would have added strength for heavy tasks.

Denticulate

One denticulate made from a biface thinning flake of Onondaga chert was recovered from unit E403N204 (Figure 6.16, Figure 6.20c). It is 29.9 mm long, 22.5 mm wide, 3.5 mm thick, and weighs 2.4 grams. It has multi-pointed wear on the right lateral edge 14.3 mm long, which extends to the distal end where the wear is convex and 13.1+ mm long. One section of the distal end is broken; so the latter measurement is incomplete.

Wedges

Two wedges or *pièces esquillées* made of Onondaga chert were recovered from Fowler (Figure 6.16). These are small, rectangular-shaped pieces with bifacial bashing on opposing edges indicated by hinge and step fractures. The first (Figure 6.21a), made from what appears to be a large biface thinning flake, was surface collected from unit E396N196. It is broken along one lateral edge, but the remaining fragment is 30.7 mm long, 27.1+ mm wide, 4.9 mm thick, and weighs 5.9 grams.

The second, from unit E406N198 (Figure 6.16, Figure 6.21b), is made from a broken scraper or, perhaps a multi-use tool. It is 25.6 mm long, 25.4 mm wide, 9.4 mm thick, and weighs 6.1 grams. The scraper wear, on what would have been the distal end of the flake, is convex in shape and 25.2 mm long.

Bifaces

Eight biface fragments were recovered from Fowler (Figure 6.16, Table 6.4), ranging in size from tiny edge fragments to biface tips. The majority are small biface fragments, the largest of which is illustrated in Figure 6.21c. The bifaces have been typed as three discrete stages in the reduction sequence: rough bifaces are simply shaped forms with large flakes scars, biface blanks have more pronounced thinning, and finished bifaces are thinner with evidence of finer flaking. The small fragments are simply listed in Table 6.4 by provenience and typed as unknown. None of these tool fragments have been identified as point preforms.

Projectile Points

Eleven projectile points and fragments were recovered from Fowler (Figure 6.16, Figure 6.22) representing a total of nine points. Two of the points are complete, three are large fragments and four are small midsection or basal fragments (Table 6.5). All are finely made with concave bases, and slightly expanding to straight lateral edges. Their bases are thinned and four of the points or fragments have fluting on one face.

These projectile points have been identified as Palaeo-Indian Holcombe type points (C. Ellis, personal communication, 1998). Holcombe points are described as small, thin fluted points with convex sides and sharp basal ears. They contract sharply towards the base, resulting in a very narrow basal width. They have grinding on the lateral edges and on the basal concavity. About one half of all Holcombe points are unifacially fluted, and they are biconvex in cross-section, although one face is usually more exaggerated (Justice 1987:24). On the basis of this description, the points from Fowler are accepted as being of the Holcombe type.

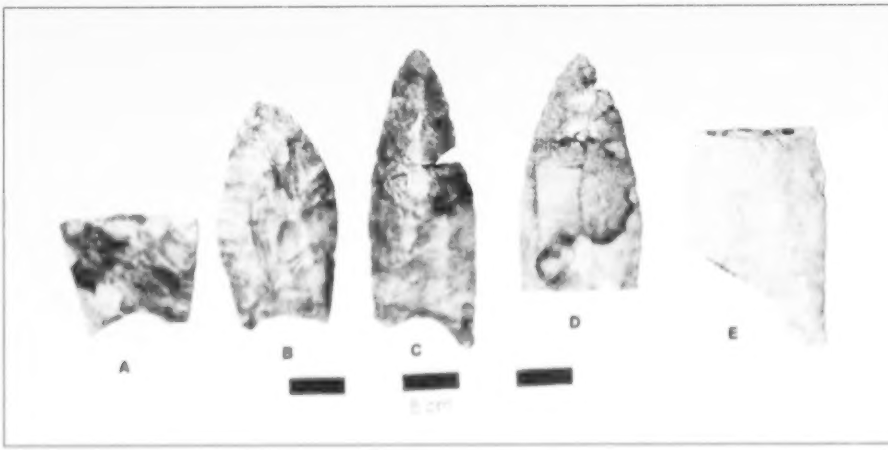

Figure 6.21 Projectile Points from Fowler (part of C and all of D are from Feature 1).

Discussion

Fowler is a small Palaeo-Indian occupation located on a relict glacial beach shoreline, higher in elevation and therefore earlier than the Algonquin/Ardtrea beach. Fowler is 15 x 17 metres in size and all the recovered material represents the Palaeo-Indian time period. One subsoil ghost feature was excavated, from which numerous pieces of debitage, greywacke spalls, a graver, a scraper and a projectile point were recovered. The recovery of channel flakes confirms that the fluting of projectile points occurred at Fowler.

Although time consuming, the results of this excavation have been greatly enhanced by the use of 3-mm mesh screen. The results of the debitage analysis are far different than would have been the case if 6-mm mesh screen had been employed during the excavation. Tool recovery also benefited from the use of 3-mm mesh screen, since a number of the very small tool fragments would have fallen through the larger mesh screen. As well, Feature 1 was first identified on the basis of the number of small flakes recovered from the upper limits of the subsoil, and it might have been missed if the larger mesh was used to screen the soil.

The chipped lithic tool assemblage, divided by material type, is provided in Table 6.6. Ellis and Deller (1990:56) report that Palaeo-Indian assemblages indicate a " ... reliance on fine-grained materials such as cherts and a tendency to focus on certain bedrock sources of some material." Most of the artifacts from Fowler, including projectile points, unifaces, biface fragments and almost 90% of the debitage, are of Onondaga chert. Collingwood chert is restricted to one point fragment, some unifaces, all of the scrapers, and half of the biface fragments. The use of Kettle Point chert is restricted to one uniface, one utilized flake and one debitage. Fowler is located approximately 100 km from the Collingwood chert source, 350 kilometres from the Onondaga source and 500 km from the Kettle Point source (Figure 6.1). The wide range of chert types at the site suggests that the occupants of Fowler were collecting chert as they followed their seasonal round.

Table 6.4 Bifaces.

Unit	Type	Material	Length (in mm)	Width (in mm)	Thickness (in mm)	Weight (in g)	Comment
E399N200	blank	Collingwood	38.3+	35.8+	8.9	9.4+	Tip fragment (Figure 6.14c)
E400N198	finished	Onondaga	17.9+	15.8+	4.7	1.0+	Possible point tip fragment
E397N200	blank	Collingwood	14.5+	14.8+	5.2	1.4+	Possible tip fragment
Feature 1	blank	Onondaga	13.6+	32.4+	8.1+	3.0+	Edge fragment
E403N201	unknown	Collingwood	–	–	–	–	Possible wedge fragment
E397N205	unknown	Collingwood	–	–	–	–	Tiny edge fragment
E397N201	unknown	Onondaga	–	–	–	–	Tiny edge fragment
E398N199	unknown	Onondaga	–	–	–	–	Possible core fragment

The coded debitage frequency distribution seems to correlate with the distribution of chipped lithic tools. There appear to be three or possibly four higher frequency or density artifact areas within the site, indicated by clusters of debitage (Figure 6.6–10), greywacke (Figure 6.13), rough stone tools (Figure 6.14) and chipped lithic tools (Figure 6.16). There does not appear to be any difference between the types of tools recovered from these areas, with point fragments mending between areas (Figure 6.16). The distribution of greywacke is also consistent between these areas. Given the small overall size of the site, the projectile point mend and the similarities between areas, these high frequency artifact areas are interpreted as use-areas rather than discrete occupations within the site limits. It is suggested that these areas were all occupied at one time. These three loci could represent distinct family groups; however this is questionable given the proximity of the loci. It would be expected that they would spread out a little further if they represented discrete, yet coexistent, occupations. It is more likely that Fowler was a single occupation, special purpose camp occupied by a small group of Holcombe hunter-gatherers, possibly an extended family band. This interpretation is consistent with what is known about Palaeo-Indian hunter-gatherers (e.g., Ellis and Deller 1990:54–63). These use-areas may simply be small work areas surrounding a small structure or dwelling. Although intriguing, extrapolating a structure based on the absence of artifacts from ploughzone squares seems tenuous at best.

The use of the feature recorded at Fowler is unknown and there are no other excavated Holcombe features from Southern Ontario for comparison. Four features excavated at the Holcombe site were accepted as being associated with the Palaeo-Indian occupation (Fitting *et al.* 1966), and there are numerous other Palaeo-Indian features for comparison (Table 6.7). This comparison indicates that the Fowler feature is much larger than the others. In addition, approximately 30 cm of cultivated topsoil was removed before the depth was measured.

Table 6.5 Projectile Points.

Unit	Material	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Basal Width (mm)	Basal Shape (mm)	Comment
E400N199 (Surface collection)	Onondaga	21.4+	24.5+	4.5	2.3+	17.9	concave	Base fragment
E407N198	Onondaga	40.0	21.5	4.1	3.7	14.5	concave	Fluted on one face
E407N195	Onondaga	52.1	18.6	4.7	4.3	18.3	concave	Fluted on one face; mend with Feat. 1 and E398N200
Feature 2	Onondaga	41.3+	21.2	4.5	3.6+	–	–	Base broken; burnt
E408N197	Collingwood	38.6+	25.4	7.5	7.3+	–	concave	Tip and basal corner facebroken; fluted on one
E399N201	Onondaga	–	–	–	–	–	concave	Base corner fragment
E398N200	Onondaga	–	–	–	–	–	concave	Base corner fragment
E398N200	Onondaga	–	–	–	–	–	concave	Base corner fragment
E401N204	Onondaga	–	–	3.8	–	–	–	Midsection fragment; fluted on one face

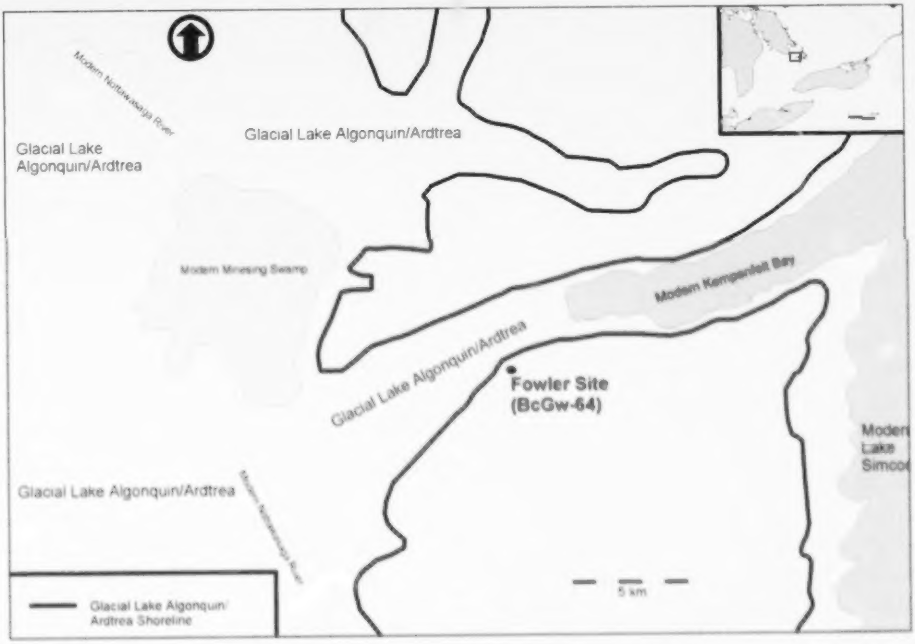
Modern Nottawasaga River
Glacial Lake Algonquin/Ardtrea
Glacial Lake Algonquin/Ardtrea
Modern Minesing Swamp
Modern Kempenfelt Bay
Glacial Lake Algonquin/Ardtrea
Fowler Site (BcGw-64)
Moder Lake Simco
Glacial Lake Algonquin/Ardtrea
Modern Nottawasaga River
5 km
Glacial Lake Algonquin/ Ardtrea Shoreline

Figure 6.22 Fowler in relation to the glacial Lake Algonquin/Ardtrea shoreline.

Table 6.6 Chipped Lithic Tool Frequency by Material Type.

Tool Type	Onondaga	Collingwood	Kettle Point	Total
Channel Flakes	3	–	–	3
Utilized Flakes	4	3	1	8
Uniface	4	2	1	7
Scrapers	–	3	–	3
Narrow End Scraper	1	1	–	2
Gravers	1	1	–	2
Denticulate	1	–	–	1
Wedge	2	–	–	2
Biface	4	4	–	8
Projectile Points	8	1	–	9
TOTAL	28	15	2	45

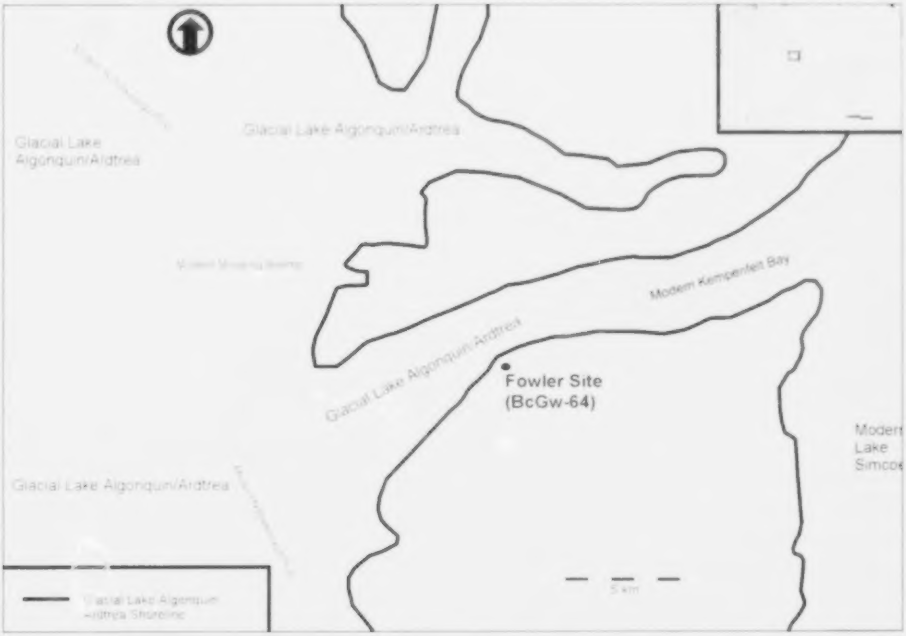
Glacial Lake
Algonquin/Ardtrea
Glacial Lake Algonquin/Ardtrea
Modern Kempenfelt Bay
Glacial Lake Algonquin/Ardtrea
Fowler Site
(BcGw-64)
Moder
Lake
Simco
Glacial Lake Algonquin/Ardtrea
5 km
Glacial Lake Algonquin
Ardtrea Shoreline

Figure 6.22 Fowler in relation to the glacial Lake Algonquin/Ardtrea shoreline.

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Utilized Flakes	4	3	1	8
Uniface	4	2	1	7
Scrapers	–	3	–	3
Narrow End Scraper	1	1	–	2
Gravers	1	1	–	2
Denticulate	1	–	–	1
Wedge	2	–	–	2
Biface	4	4	–	8
Projectile Points	8	1	–	9
TOTAL	28	15	2	45

Although the data from Feature 1 at Fowler is most consistent with a meat cache, its exact use can only be hypothesized. There are a number of possible explanations for this feature. It may simply represent smaller subsoil pits dug side-by-side, but the artifact distribution does not support this conclusion. This feature could be a tree-throw or a refuse- filled depression that was capped during years of mechanical cultivation. However, these explanations seem unlikely given that there was no colouration in the subsoil. The length and width of this feature suggest that it could have been manufactured as a hunting blind on the relict beach, but the relics recovered from this site indicate that this was not simply a short-term hunting camp. As well, environmental reconstructions for this time (to be discussed later in this report) suggest that this area would have been treed at the time of the Holcombe occupation.

The size of the feature and its overall shape, the recovery of a point fragment, scraper fragment, and the high frequency of edge trimming flakes and greywacke spalls in the feature are consistent with an interpretation as a storage pit, possibly the remains of a meat cache. The projectile point may have been lodged in a kill; the edge trimming flakes would have been produced through the resharpening of bifacial tools used while butchering, and the greywacke spalls could have been produced if large chopping tools hit bone. Why these activities may have occurred within the cache is unknown. Although its use as a meat cache is inferred because of its size, the artifacts recovered from Feature 1 complement this interpretation. Smaller meat caches have been noted in the Northwest Territories (personal observation 1987), but these generally contained only fish remains that would presumably have been used for dog food (Jean-Luc Pilon, personal communication 2001). As well, an Early Palaeo-Indian aboveground rock cache was found at the Adkins site, in the Magalloway River Valley in Maine (Gramly 1988). It is described as a rock cairn constructed using large boulders with smaller ones filling in the gaps, but with no associated artifacts (Gramly 1988:15). The absence of artifacts makes one wonder why it has been interpreted as cultural, but this cache differs greatly from the subterranean cache inferred from artifact distribution at Fowler.

There are no direct seasonal indicators from the Fowler site, so it could presumably have been occupied at any time of year. However, Feature 1 at Fowler could not have been dug while the ground was frozen. The identification of Feature 1 as a possible meat cache implies with some certainty a warm season occupation, since a meat cache would not be necessary to preserve meat in winter. As well, if the occupants were following migratory caribou, then the herds may have been further south during the winter months, and thus, further from the glaciers.

Given the number and variety of tools recovered, the use areas, and the possibility of a meat cache, it is suggested that Fowler was occupied over a fairly long period of time. The wide range of tools, such as scrapers, gravers, unifaces, *pièce esquillée* and projectile points, and the high frequency of edge trimming and scraper retouch flakes all suggest an assortment of tasks undertaken during a fairly long-term occupation.

Holcombe points are thought to date to the early Late Palaeo-Indian period, ca. 8,300 B.C. (Ellis and Deller 1990:40), and are found throughout the Great Lakes area (Justice 1987:44–46), from Michigan (Fitting 1975) to southeastern Ontario, south of Rice Lake (Ellis and Deller 1990). In southern Ontario, however, few Holcombe points have been found and

Table 6.7 Size Range of Palaeo-Indian Features from Southern Ontario and the Holcombe site

	Site	Feature #	Cultural Affiliation	Length (cm)	Width (cm)	Depth (cm)	Type	Reference
1.	Thedford II	3	Parkhill	250	64	20	Unknown	Deller and Ellis 1992:94
2.	Thedford II	8	Parkhill	180	134	42	Unknown	Deller and Ellis 1992:94
3.	Thedford II	10	Parkhill	150	150	29	Unknown	Deller and Ellis 1992:94
4.	Thedford II	13	Parkhill	150	80	16.5	Unknown	Deller and Ellis 1992:97
5.	Udora	1	Gainey	200	200	29	Unknown	Storck and Speiss 1994:122
6.	Sandy Ridge	3	Gainey	235	85	20	Hearth	Jackson 1998:31
7.	Sandy Ridge	4	Gainey	147	124	35	Unknown	Jackson 1998:32
8.	Sandy Ridge	5	Gainey	82	80	5	Hearth	Jackson 1998:32
9.	Halstead	3	Gainey	96	73	30	Hearth	Jackson 1998:54
10.	Halstead	4	Gainey	117	93	15	Unknown	Jackson 1998:54
11.	Koeppe II	1	Hi-Lo	140	130	60	Unknown	Woodley 1997:165
12.	Koeppe II	2	Hi-Lo	45	35	40	Unknown	Woodley 1997:165
13.	Koeppe II	3	Hi-Lo	140	90	20	Unknown	Woodley 1997:165
14.	Fowler	1	Holcombe	400	165	30	Meat cache	This report
15.	Holcombe	1	Holcombe	60	60	9	Unknown	Fitting et al 1966:13
16.	Holcombe	2	Holcombe	55	55	9	Unknown	Fitting et al 1966:14
17.	Holcombe	4	Holcombe	122	91	9	Unknown	Fitting et al 1966: 14
18.	Holcombe	8	Holcombe	213	122	9	Unknown	Fitting et al 1966:16

they are primarily restricted to the southcentral and southwestern parts of the province (see Jackson, this volume). They have been identified from surface surveys east of Lake Huron (e.g. Deller, Ellis and Kenyon 1986; Ellis and Deller 1990: Fig. 3.10) and north of Lake Ontario (Ellis and Deller 1990: Fig. 3.10). During an extensive survey of the north shore of Lake Ontario, Roberts (1985) found no Holcombe points. One isolated Holcombe point was found in 1940 in Wentworth County near the west end of Lake Ontario (L. Jackson, personal communication 1998), and Ellis and Deller (1990:Table 3.2) report two Holcombe sites and four Holcombe-like sites in Ontario. On the basis of the scanty data available, it appears that Holcombe sites are rare in southern Ontario.

The Fowler tool assemblage is nearly identical to that recovered from the Holcombe site, Michigan (Fitting, DeVisscher and Wahla 1966). Located northwest of Detroit, Michigan, the Holcombe site is located on a beach from glacial Lake Clinton, approximately 10 miles west of Lake St. Claire (Fitting, DeVisscher and Wahla 1966:1). The Holcombe site location is described as being a " ... high and dry plateau" Fitting *et al.* 1966:2) and, at the time of occupation, it was located in what would have been a pine dominated forest with some spruce and hardwoods (Kapp 1999:50, Figure 2.5). Four subsoil features at Holcombe were accepted as being Palaeo-Indian in age; however they are much smaller than Feature 1 at Fowler (Table 6.7). The assemblage at Holcombe contained over 8,000 chert artifacts, of which 393 are chipped lithic tools. Included in the Holcombe assemblage are numerous wedges or *pièces esquillées*, 112 bifaces, 25 scrapers, five gravers, and fragments from 108 projectile points. Like those from the Fowler site site, 40% of the points from Holcombe are fluted on one face. The material used at Holcombe is almost completely restricted to Bayport chert with only 3% identified as exotic (Fitting *et al* 1966:19). Also recovered were a number of objects identified as slate, but described as greenish, chipped and battered, which sounds similar to the greywacke recovered from Fowler.

Although it is a much smaller assemblage, the Fowler artifacts are remarkably similar to the chipped lithic assemblage recovered from Holcombe. The fluting and the similarity of the tool assemblage between the two sites suggest that the Fowler site and the Holcombe sites were occupied at approximately the same time. The recovery of the Kettle Point chert from Fowler indicates ties to the southwest, close to the location of the Holcombe site, either through the direct procurement of material or through trade.

The chipped lithic tools from both the Fowler and Holcombe sites are similar to those from Early Palaeo-Indian sites in eastern North America (eg., Ellis and Deller 2000, Deller and Ellis 1992, MacDonald 1985). There is an overwhelming similarity with the use of chert types, fluted scraper, narrow end scrapers, unifacial tools or raclettes, gravers, *pièce esquillée*, channel flakes, and fluted projectile points. The channel flakes are somewhat narrower and thinner than those recovered from Early Palaeo-Indian sites (Woodley 2001:7, Table 2). The Fowler artifacts have less in common with the artifact assemblages recovered from Late Palaeo-Indian sites. Although an extensive comparison is beyond the scope of this report, it is suggested that Holcombe occupation sites are late Early Palaeo-Indian or possibly transitional, rather than Late Palaeo-Indian.

Accepting a 10,400 to 10,200 B.P. date for the Holcombe occupation of Fowler, marl and wood deposits from lake cores indicate that the mean annual temperature would have been about six to eight degrees Celsius cooler than at present. In addition, the environment would have been much drier (Edwards and Fritz 1988) with it being described as "Early Postglacial" (Edwards and Fritz 1988:1405, Figure 8). By 10,500 B.P., both Lake Erie and Lake Ontario were much smaller than at present, and glacial Lake Algonquin extended southward from what is now the Lake Huron basin to cover and extend beyond the shores of modern Lake Simcoe (Karrow and Warner 1990:Figure 2.11). At this time, the glaciers had receded to north to what is now Georgian Bay/Lake Huron (Karrow and Warner 1990:17, Figure 2.9). Similar to the environment for the Holcombe site, southcentral Ontario would have been a closed pine forest with some oak and ironwood, and a wide array of tree and plant species. Many animal species would have also been available for hunting (e.g., Keene 1981). This type of environment would have provided an extensive and diverse subsistence base throughout the year.

Aspects of the modern topography immediately north of Fowler include a stream and low-lying boggy area. No coring was done, but given the elevation, it is presumed that what is now cedar swamp would have been open water during the Late Palaeo-Indian period. Also, taking into consideration the cold and dry environment, a reliable water source would have been a requirement for site location. The glacial Lake Algonquin shoreline was located north and at a slightly lower elevation (Deane 1950) than the Fowler site. This shoreline is reconstructed in Figure 13 from Deane (1950). Fowler is located approximately 12 metres in elevation above the Lake Algonquin shoreline. This reconstruction clearly indicates that the Fowler site is located near the shore of what was a narrow section of glacial Lake Algonquin or, possibly Lake Ardtrea (Jackson *et al* 2000). East of the site, the lake expanded to cover most of Barrie and Kempenfelt Bay of Lake Simcoe, and west of the site, the lake expanded to cover all of what is now the Minesing Swamp. North of the site would have been the lake narrows and then dry land. The Early Palaeo-Indian Standing Tree site (Woodley 2001) is located about 250 metres north of Fowler on the Lake Algonquin/Lake Ardtrea shore. The location of this earlier site at a lower elevation confirms that the Fowler site could not have been situated on an active beach, but rather the occupants chose to utilize a relict beach.

Caribou remains have been recovered from a number of Palaeo-Indian sites in the Lower Great Lakes (e.g., Cleland 1965; Storck and Speiss 1994). Stork and Speiss (1994) discuss the recovery of caribou remains from Early Palaeo-Indian sites in southern Ontario including the Udora site, located about 50 km southwest of Fowler; so it is likely that a caribou population remained available to the occupants of Fowler. This is consistent with the recovery of caribou bone from a feature at the Holcombe site (Cleland 1966). Given its location on a ridge overlooking a narrow shallow area, Fowler would have been in an ideal spot to locate migratory animals. Cervids (i.e., caribou) and other game animals may have congregated nearby before crossing the glacial lake during their annual seasonal migration, and they would have provided a variety of resources for Holcombe hunter-gatherers (Banfield 1974:385). The wide range of raw materials from Fowler suggests that these materials were collected during the annual seasonal round, perhaps while following migratory caribou. The Holcombe site location was described as a plateau (Fitting *et al.* 1966:2), which suggests that it was also located on a ridge with a view of lowland areas. The Fowler site location is similar to those noted in the Northwest Territories (personal observation 1987), where kill sites are located close to lake narrows in order to provide easy access to caribou crossings. This hypothesis is not intended to suggest that only cervids were hunted, but rather that there would have been a variety of plant and animal species available for resource extraction.

An alternative and equally viable interpretation is that Fowler was occupied after the glacial lake had already receded, leaving open water to the east over Kempenfelt Bay and west over what is now the Minesing Swamp. However, the elevation of the narrows north of Fowler suggests that this area would have been swamp or wetland environment. It was hoped that the results of the radiocarbon date from Fowler would determine if this site was associated with a glacial lake or the later swamp. However, unfortunately, the fairly recent results could not be used to substantiate this hypothesis; so, the question remains whether these narrows were open water or swamp. Depending on which answer is more correct, there would have been slightly different resources available for extraction. This hypothesis places a slightly different interpretation on site location, with a variety of resources associated with the swamp available for extraction. A detailed discussion of this environment and its associated ramifications is beyond the scope of this report, although a focus on swamp related resources might alter how we view Palaeo-Indian hunter-gatherers. Employing either hypothesis, it is suggested that the occupants of Fowler chose this location on a relict beach ridge because it provided an excellent view of the low area and its associated resources.

Conclusions

The Fowler site is a small, single occupation Palaeo-Indian Holcombe type campsite that was occupied ca.10,300 B.P., and located on a relict shoreline west of Barrie. One ghost feature was identified based on the distribution of artifacts in the subsoil. The large size and contents have lead to its identification as a meat cache. Although there were no direct indicators of site function or seasonality recovered from Fowler, the interpretation of Feature 1 as a meat cache and the predominance of biface edge trimming flakes suggest that it is the remains of a kill/butchering/storage site. Logic suggests that the feature was dug while the ground was not frozen, which leads to the conclusion that the occupation would have occurred at some point between spring and fall. The preferred material at Fowler for tool manufacture is Onondaga chert; however, some Collingwood chert and a few tools and flakes of Kettle Point chert are also present. The tool assemblage contains an assortment of tools, with unifacial tools, gravers, narrow end scrapers, fluted scraper and Holcombe type projectile points that are fluted on one face. Three or, possibly four, use areas were defined, based on the artifact distribution pattern. These use areas may have surrounded a small structure.

The tool assemblage is nearly identical to that found at the Holcombe site in Michigan. As well, the assemblage has many similarities with Early Palaeo-Indian assemblages and less in common with Late Palaeo-Indian assemblages, which suggests that Holcombe sites should most likely be identified as late Early Palaeo-Indian. Fowler is ideally located, overlooking either a glacial lake channel or swamp, which permits interception of migratory animals and exploitation of associated resources. Caribou may well have been intercepted as they crossed the narrows to the north, and, as well, if caribou were following migratory patterns similar to those of modern-day caribou, then the herds and hunter-gatherer bands would have been further south during the winter months. This leads to the hypothesis that the raw chert recovered from Fowler may have been collected as the band followed migratory caribou to the southwest.

Very few Holcombe sites have been found in southern Ontario, so few inferences can be made about the size and adaptations to specific environments. At best, the Late Palaeo-Indian occupation at Fowler and the fairly sparse Holcombe occupation of southern Ontario indicate a series of small, special purpose Palaeo-Indian camps utilized during annual hunter-gatherer seasonal rounds.

Acknowledgements

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7.

Lake Level Changes and Aboriginal Cultural Manifestations in Areas Adjacent to and Including Niagara Peninsula

James W. Pengelly and Keith J. Tinkler

Abstract

Variable lake levels through postglacial time have helped to drive cultural changes and shifts in point styles in the lower Great Lakes. Lake level changes have been largely controlled by the changing physical geography of the Great Lakes region, as glaciers have retreated and advanced, and as proglacial lakes have changed their outflow directions. In particular, high magnitude outflows eastwards from Lake Agassiz to the Great Lakes in association with rapid rates of early postglacial isostatic uplift have caused relatively rapid changes in coastlines. Although the changes are slow enough not to have caused catastrophic overwhelming of coastal human communities, they have through time changed the migration routes of animals, and the distribution of precious food and water resources. The availability of chert for the tool making has sometimes been affected by the submergence of outcrops under lake waters – for example the Onondaga chert along the northern Lake Erie shoreline.

Résumé

Des niveaux lacustres variables durant le postglaciaires, ont entrainés des changements dans la culture aborigène et dans le style des pointes de flèches, dans la région des Grands Lacs. Les changements de niveaux ont été largement contrôlés par une géographie physique changeante de la région des Grands Lacs, avec les avancées et les retraites des glaciers, et les changements de direction de l'écoulement des lacs proglaciaires. En particulier, des débâcles de grande magnitude vers l'est, du Lac Agassiz jusqu'au Grands Lacs, associées à un soulèvement isostatique rapide ont causés des changements assez rapides dans les région côtières. Même si les changements ont été assez lents pour ne pas avoir affectés catastrophiquement les communautés humaines côtières, ils ont, avec le temps, modifiées les routes de migration des animaux et la distribution de précieuses ressources de nourriture de d'eau. La disponi-

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bilité du chert, utilisé dans la fabrication d'outils, a parfois été affectée par la submergence des affleurements sous les eaux des lacs, comme pour le chert Onondaga par exemple.

Introduction

It is difficult to define exactly what factors drive cultural changes or even changes in point styles. Brian Fagan, in his book "floods, Famines and Emperors" (1999), defined some of the reasons for our lack of understanding with regard to the effects of changing weather conditions on cultures. Up until probably the last decade archaeologists, who were focusing their attention on cultural transitions, were not strongly connected to the scientists who were analyzing changes in weather and its subsequent effects on plants and animals. Research on the El Niño and its effects on world climate, has assisted us in gaining a better understanding of the dramatic effects that climatic conditions in one part of the world can have on people who reside thousands of kilometres away. Fagan points out that we are now beginning to recognize the fact that short-term climatic anomalies have a strong correlation with the transitions in cultures.

This paper reviews the lower Great Lakes area, focusing on the Niagara Peninsula, to determine if there are discernible correlations between the changes in lake levels, climate, and vegetation, and the established patterns in the aboriginal cultural manifestations such as point types, in the Palaeo-Indian and Early Archaic time periods.

Lake Level Changes and Causes

Over the last 10 years, several papers (Tinkler *et al.* 1992, 1994; Tinkler and Pengelly 1995; Pengelly *et al.* 1997; Pengelly 1990) have been written about the causes and effects of lake level changes in the eastern Lake Erie Basin. At this time, we present a summary of lake events that took place during the Palaeo-Indian and Early Archaic periods. In order to understand why each of the rises took place, it is essential to review the controlling factors that determine the height of the lake level rise during this period. The main controlling factors include 1) the discharge of water through Lake Erie by the upper Great Lakes; 2) the height and location of the rock sill controlling the outflow from Lake Erie; 3) the long term, climatically-driven factors affecting the level of Lake Erie and the Great Lakes, in general; 4) the amount of isostatic rebound that has taken place since glaciation; and 5) the extremely subdued topography of the southern Niagara Peninsula, along with the broken character of the Onondaga escarpment, which enables Lake Erie at high water levels to breach the escarpment and flood the lands north of it.

Lake Agassiz outflows to the Great Lakes basin during the Younger Dryas period, 11,200 to 10,300 B.P., coincide with the Palaeo-Indian fluted point period in Ontario prehistory. The Main Algonquin lake level for the same time period has been known and accepted for many years in the Upper Great Lakes. It is only recently that we have recognized the information postulated by Kindle and Taylor (1913) and Leverett and Taylor (1915). At that time, they stated that the Upper Great Lakes at this stage were confluent with the Erie basin, including the extensive shallow Lake Tonawanda, which fed the Niagara River (Pengelly 1990; Pengelly

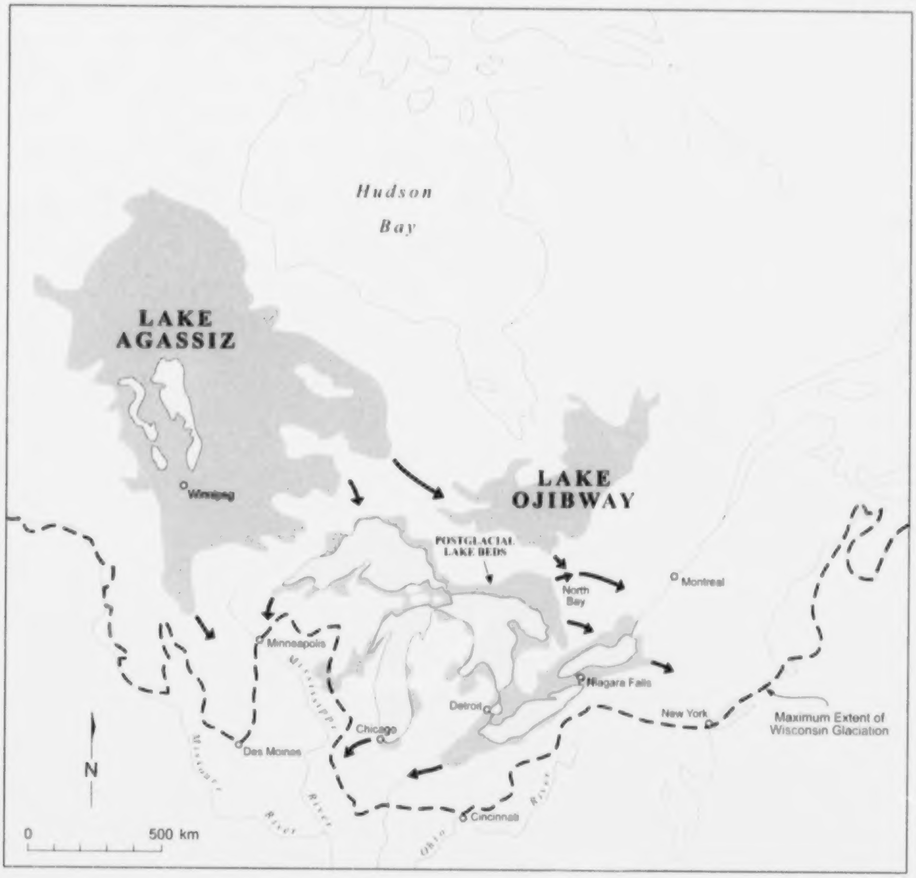
Hudson Bay
LAKE AGASSIZ
Winnipeg
LAKE OJIBWAY
POSTGLACIAL LAKE BEDS
North Bay
Montreal
Niagara Falls
New York
Maximum Extent of Wisconsin Glaciation
Detroit
Minneapolis
Chicago
Des Moines
Cincinnati
Mississippi River
Missouri River
Ohio River
N
0
500 km

Figure 7.1 The Relationship of Lake Agassiz and Lake Ojibway to the Great Lakes. The areas of postglacial lake beds are shown and the maximum extent of the Wisconsinan Glaciation, (Taken from Tinkler *et al.* 1992).

et al. 1997; Tinkler *et al.* 1992; Lewis and Anderson 1992; Rea *et al.* 1994). The controlling sill was the Lyell-Johnston sill within the upper Niagara Gorge.

The main cause of the rise in lake levels was the variable flow of water out of Lake Agassiz into the Great Lakes system. Lake Agassiz was a huge proglacial lake covering most of the Prairies west of Winnipeg, impounded between the retreating ice sheets and the rising land to the south of it during the Postglacial period (Figure 7.1). Leverington *et al.* (1999), Teller and Thorleifson (1987), Teller (1990), and Lewis and Anderson (1989) have studied the baseline discharge out of Lake Agassiz, together with short-lived catastrophic discharges. From time to time during its existence, lower outlets appeared on the eastern margins of the lake. When this happened, large quantities of water discharged through Lake Nipigon into the

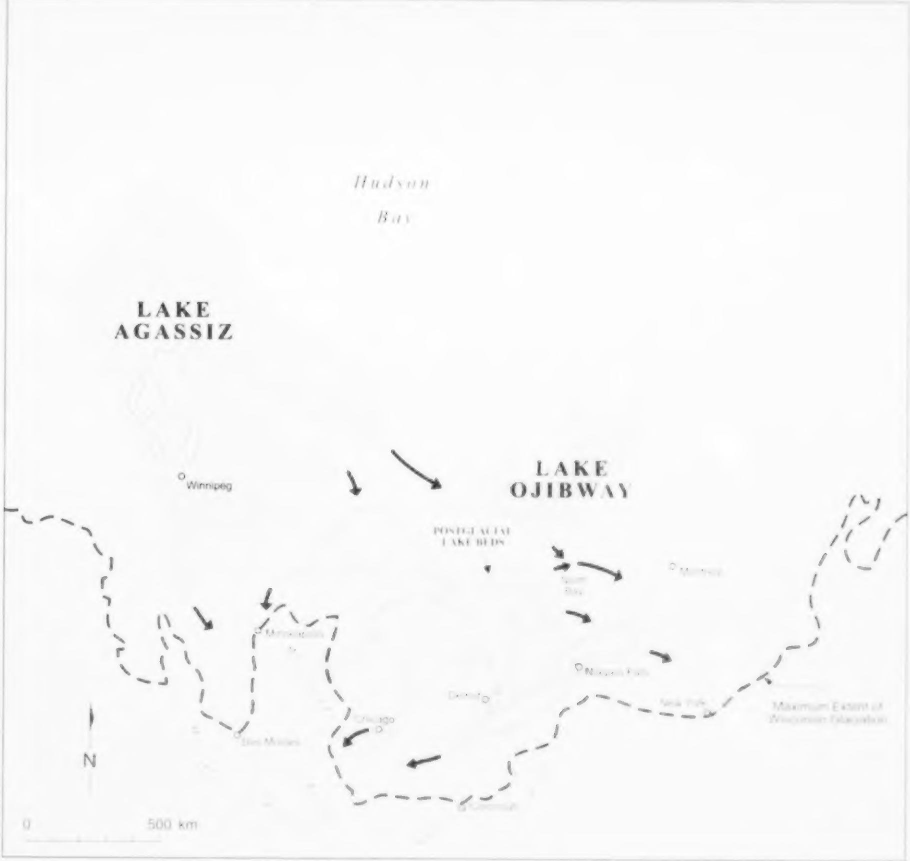
Hudson
Bay
LAKE
AGASSIZ
Winnipeg
LAKE
OJIBWAY
POSTGLACIAL
LAKE BEDS
Montreal
North
Bay
Minneapolis
Niagara Falls
Detroit
New York
Maximum Extent of
Wisconsin Glaciation
Chicago
Des Moines
Cincinnati
N
0
500 km

Figure 7.1 The Relationship of Lake Agassiz and Lake Ojibway to the Great Lakes. The areas of postglacial lake beds are shown and the maximum extent of the Wisconsinan Glaciation. (Taken from Tinkler *et al.* 1992).

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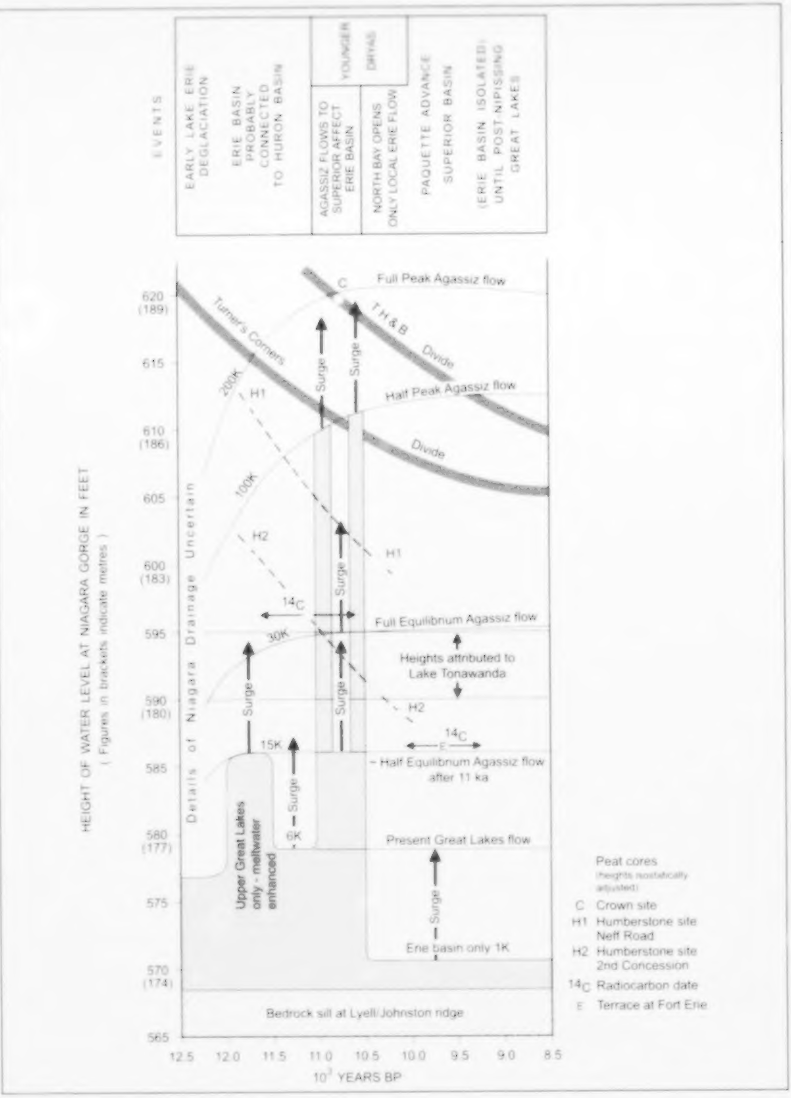

Figure 7.2 The diagram indicates which spillways out of the Erie basin were active, and with what discharges (in 1000 m3s-1 abbreviated as K in this figure), as a function of time B.P. and the total discharge, after adjustment for isostatic rebound. (For relevant water levels in the Niagara Gorge, see Figure 7.2). Box sizes are proportional to discharge, and the same schematic discharge history is assumed as in Figure 7.3. The outlet at Holley also takes into account the newly-recognized outlet to the southeast. Notice the early abandonment of the eastern spillways of, Lake Tonawanda (due to rapid early isostatic rebound) for substantial flows early in the postglacial period (by 12 ka). The very highest water levels during the period 11.0-10.5 ka would have re-activated all Lake Tonawanda spillways at about 10.5 ka, including those at the eastern end, and spillways west of the Niagara River. Wind-set seiches would generate very substantial flows, but only for a few hours. (After Tinkler *at al.*, 1992).

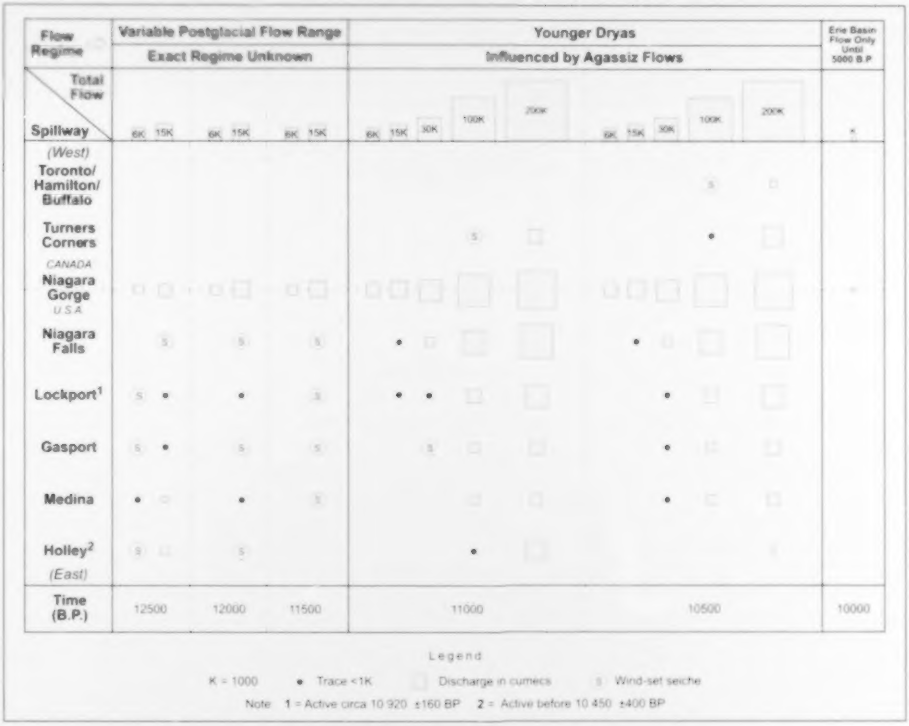
Flow Regime
Variable Postglacial Flow Range
Exact Regime Unknown
Younger Dryas
Influenced by Agassiz Flows
Erie Basin Flow Only Until 5000 B.P.
Total Flow
Spillway
6K
15K
30K
100K
200K
(West)
Toronto/ Hamilton/ Buffalo
Turners Corners
CANADA
Niagara Gorge
U.S.A.
Niagara Falls
Lockport¹
Gasport
Medina
Holley²
(East)
Time (B.P.)
12500
12000
11500
11000
10500
10000
Legend
K = 1000
• Trace <1K
Discharge in cumecs
S Wind-set seiche
Note: 1 = Active circa 10 920 ±160 BP 2 = Active before 10 450 ±400 BP

Figure 7.3 A time/height diagram of potential discharges generated out of the Erie basin system as a function of the water level at the entrance to the Niagara Gorge, and the time b.p., after adjustment for isostatic rebound. (Figure 7.4 shows which spillways were active as a function of discharge and time b.p.). The Niagara River Lyell/Johnson sill is modeled with a fixed value of 568 feet (173.2 m). Flows in units of 1000 m3s-1 abbreviated to K in this figure.

The water level in the Erie basin at a point in time may be read off the diagram according to any scenario of discharge envisaged. Darkest stipple indicates an approximate, and schematic. Discharge through the Erie basin on the assumption that between 11.0-10.5 ka half of the Agassiz flow inflow to the upper Great Lakes was routed through the Erie basin (Anderson & Lewis, 1989), until the North Bay route opened up at about 10.5 ka. Prior to 11.0 ka the discharge scenario assumes (I) flows generated according to Figure 7.5 in Teller (1990) and (ii) q continuous connection (confluence) between Huron and Erie basins. Vertical bars marked surge indicate very short-term changes of lake level (by ± 2m, 8ft) as a function of wind-set seiches on Lake Erie, comparable to present ones. They are marked in order to show elevations reached above stable lake levels. Medium stipple shows the height range attributed to Lake Tonawanda shorelines. Open stipple models the changing elevation of two divides (TH&B and TC) in the Niagara peninsula (relative to the entrance of the Niagara Gorge) which could only have overflowed during exceptionally high lake levels.

Dated pollen cores (14C or pollen zones, see text) are marked at their isostatically adjusted heights: C, Crown Site; H1, Humberstone (Neff Road); H2, Humberstone (Second Concession). E, raised terrace at Fort Erie. Three standard deviation error bars are marked for 14C dates. (Taken from Tinkler *et al.* 1992).

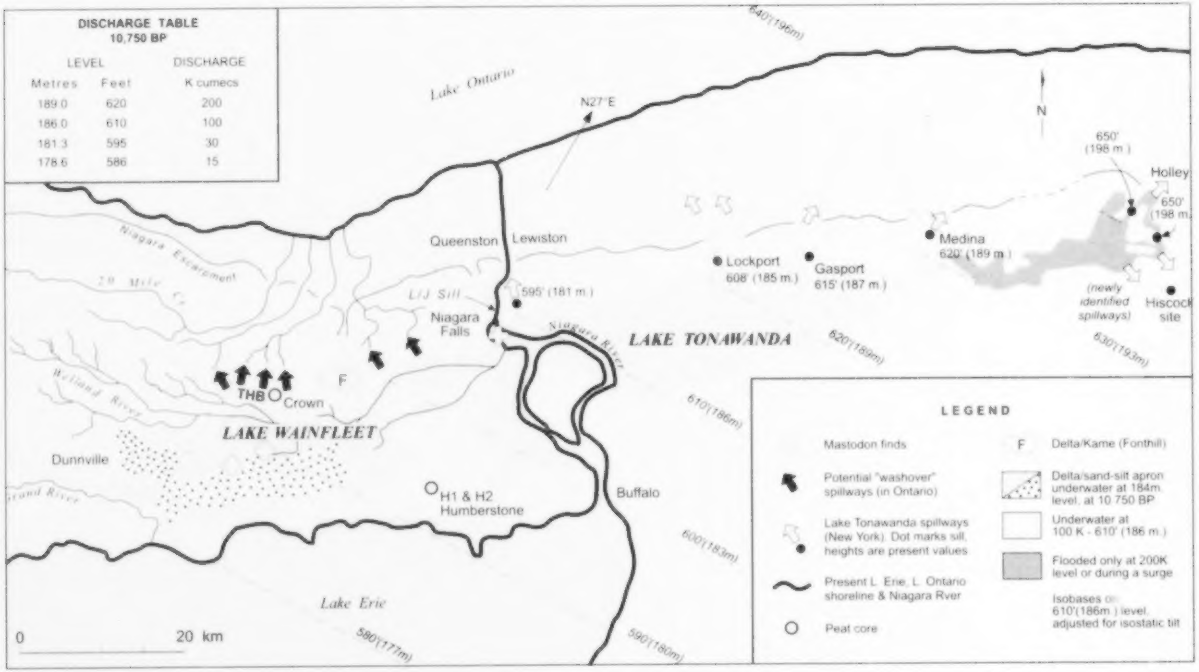
DISCHARGE TABLE
10,750 BP
LEVEL
DISCHARGE
Metres
Feet
K cumecs
189.0
620
200
186.0
610
100
181.3
595
30
178.6
586
15
Lake Ontario
N27°E
N
640'(196m)
650' (198 m.)
Holley
650' (198 m.)
Niagara Escarpment
20 Mile Cr.
Queenston
Lewiston
Lockport 608' (185 m.)
Gasport 615' (187 m.)
Medina 620' (189 m.)
L/J Sill
595' (181 m.)
Niagara Falls
Niagara River
LAKE TONAWANDA
620'(189m)
(newly identified spillways)
Hiscock site
630'(193m)
Welland River
THB
Crown
F
LAKE WAINFLEET
Dunnville
Grand River
H1 & H2 Humberstone
Buffalo
610'(186m)
600'(183m)
Lake Erie
0
20 km
580'(177m)
590'(180m)
LEGEND
Mastodon finds
Potential "washover" spillways (in Ontario)
Lake Tonawanda spillways (New York). Dot marks sill, heights are present values
Present L. Erie, L. Ontario shoreline & Niagara Rver
Peat core
F Delta/Kame (Fonthill)
Delta/sand-silt apron underwater at 184m. level, at 10 750 BP
Underwater at 100 K - 610' (186 m.)
Flooded only at 200K level or during a surge
Isobases on 610'(186m.) level, adjusted for isostatic tilt

Figure 7.4 The physical geography of the Niagara peninsula and western new York showing Lake Tonawanda, Lake Wainfleet and related spillways at 10.75 ka. Lake Tonawanda is based on Kindle & Taylor (1913), the Dunnville delta is based on Feenstra (1986) and Patirik (1982). Isobases are shown for 10.75 ka for the 186-metre level (610 feet) at the Niagara Gorge, corresponding to a through discharge of 100,100 m3s-1. Potential wash-overs at divides in Niagara peninsula are shown as TH&B (Toronto, Hamilton and Buffalo railway), and TC (Turner's Corners). (Taken from Tinkler *et al.* 1992.)

lower Great Lakes. As much as 9,500 km3 of water was added to Lake Superior over a period of about two years, where water levels rose between 10 and 30 metres (Leverington *et al.* 1999, Tinkler and Pengelly 1995).

The average outflow, when Lake Agassiz was at its equilibrium flow between catastrophic outflows, was about 50K cumecs (Leverington *et al.* 1999). If Lewis and Anderson (1989) are correct in saying that at times, up to 100K cumecs were routed to Lake Erie, then the implications can be assessed by modeling these discharges from Lake Erie to Lake Ontario via the available topographic routes. We have modeled (Figures 7.2, 7.3) a range of discharges and the lake levels required to drive them, through all possible spillways, with allowances made for isostatic tilting (Tinkler *et al.* 1992; Tinkler and Pengelly 1995). Figure 7.4 shows from field evidence, the resulting size and locations of Lake Erie, Lake Wainfleet and Lake Tonawanda, in addition to other relevant facts such as isobases of rebound, outlet locations, and lake levels with varying rates of flow.

Kindle and Taylor (1913) were the first to show that the earliest outlets from the Erie basin to the Ontario basin were through Lake Tonawanda. The most easterly outlets were at Holley, 100 km east of the Niagara River, and the most westerly were two at Niagara Falls. The outlets between them include those at Lockport, Gasport and Medina. Subsequent isostatic rebound has since tilted the region so that the Holley spillway is now at 198.2 m, compared with the Niagara Falls spillway at 177.4 m. Kindle and Taylor (1913) state, but do not map, the fact that Lake Tonawanda extended up to 10 miles west of the present Niagara Falls. Pengelly (1990) and Tinkler *et al.* (1992) were the first to outline the approximate western extension of Lake Tonawanda, and they called this water-covered area Lake Wainfleet. In 1998, an excavation for the purposes of a waterline installation along the second concession, east of Port Colborne, uncovered a notch cut into the clay at the 184-metre level, which was partly covered with beach gravel and sand. The beach notch probably represents a lake level during the Algonquin when the lake was steady at equilibrium flows.

Because Agassiz-induced inflows might have raised lake levels even higher, the divide west of the Niagara River was inspected for possible outlets. Two possible new outlets were identified, east and west of the Fonthill kame delta. The outlets are broad level surfaces, with "lows" at Turner's Corners, (marked TC on Figure 7.4); and they are located at an elevation of 185.5 m, on the east side of Fonthill, and at an elevation of 184.3 m west of Fonthill (marked THB on Figure 7.4). These low points had not previously been identified as potential overflow points for Lake Erie. At Turner's Corners, there is a very shallow channel 200 m wide across the clay divide. The surface of both areas is heavy lacustrine clay/silt. The divide crest has extremely gentle slopes to the north and south. It still carries the surface ribbing, or "small moraines" (Loken and Leahy; 1964), which have a relief of one to two metres with a spacing between the "moraines" of about 40 to 70 m. The existence of these glacial features suggests that flow over these areas was never very deep or fast flowing.

Several factors are not modeled in Figures 7.2 and 7.3. These include secular lake level fluctuations, wind sets, and a factor that is rarely mentioned – ice blockage of the outlets.

Local climate changes that occur over a few years or decades can alter the present levels of Lake Erie by ± 0.9 m above and below present datum of 173.12 m. Annual and short-term variations must have been much greater in the past when Main Lake Algonquin was a proglacial lake (on its northern shore).

Because of its orientation and shallowness, Lake Erie is very sensitive to wind-generated seiches (wind-set surges), which can raise water levels along the Erie shoreline up to 2.4 m for short periods (a few hours) in association with strong wave action on the beaches. Such wind sets today occur with a recurrence interval on the order of years (Libicki and Bedford 1990; Tinkler *et al.* 1992).

Winter ice on Lake Tonawanda, Lake Wainfleet, and Lake Erie may also have impeded flow down the usual outlets. Any substantial blockage would cause short-term rises in lake levels. A simple calculation shows that rises in excess of 0.5 m would occur within a few days if all outlets were blocked. In the strong cooling climate phase that accompanied the Main Lake Algonquin rises, severe ice conditions would have been likely (Phillips and Fralick 1994) and the broad, shallow spillways would have served to exacerbate matters. Although the situation is now controlled by an ice boom at Fort Erie, records show that occasional cessation of flow has occurred in the Upper Niagara River during the nineteenth century (Lachlan 1855, Spencer 1910).

As a result of the interplay of these various factors, any given outlet may have come dangerously close – within a metre or two – to overflowing. Because there has been noticeable isostatic rebound in the region since glaciation, it was essential that we determine the degree of tilting before we could reconstruct the water level for any particular time period. Without going into detail, we computed the amount of tilt as 0.22 m/km east-west and 0.47 m/km north/south. A half time of 1575 years was used for the rebound equation. It was assumed that all the spillways were mutually horizontal at 12,500 B.P. (Tinkler *et al.* 1992).

The Lyell/Johnson sill in the Niagara Gorge, which is currently estimated to be at a height of 172.3–173.2m (3 m higher than the present Peace Bridge sill), was the controlling sill for lake levels from about 11,500 to 3,500 B.P., and all outlets are modeled from this base point. The model was run for the range of lake levels necessary to generate outflow discharges up to 200K cumecs and over a time period 12,500 B.P. and 10,000 B.P. (Tinkler *et al.* 1992). Figure 7.2 indicates some of the discharges mentioned in the cited literature. After 11,000 B.P., and as a result of isostatic rebound that raised land to the east, outflow to Lake Ontario would have been concentrated through the Niagara Gorge, together with about 13% through the spillway that ran through the city of Niagara Falls, New York. Figure 7.3 indicates the outlets that would have been utilized at different times, as well as their various flow amounts.

Position of Niagara Falls During the Palaeo-Indian and Early Archaic Periods

Tinkler, Pengelly, Parkins and Asselin (1994) studied the erosion rates of sections of the Niagara Gorge, especially at the Niagara Glen. Niagara Falls started eroding back from the Niagara Escarpment at about 12,600 B.P. We use the cross-sectional area of the present Upper Great Gorge (all gorge section names are from Kindle and Taylor 1913) as a reference point of 1.00. Other sections of the gorge are compared to it in order to estimate discharge that may have been needed to excavate each section. It is important to note that this comparison is only a rough guide, because each excavated gorge section does not stop enlarging. Subsequent larger flows may undermine the downstream gorge walls and promote slope retreat. The first section south of the escarpment is called the Lewiston Branch and it has a ratio of 1.23 in comparison to the Upper Great Gorge. Although discharge is comparable to that of today (Tinkler *et al.* 1994), this section (610 m) was excavated during the time of the Early Algonquin rise, a time when Niagara was not the only outlet for Lake Erie outflow. The second branch is the Old Narrow Gorge (1940 m), with a cross-section ratio to the Upper Gorge of 1.10. It was excavated prior to 10,500 B.P. when all the Lake Erie outflow was moving through this gorge with a similar magnitude to the outflow of today.

The next section is located south (950 m), and it is the widest of the sections to be compared. Running from the north end of the Niagara Glen to just south of the hydroelectric stations, it has the largest ratio of 1.45. It was excavated during the Main Algonquin rise in Lake Erie from 11, 200 to 10,300 B.P. As indicated, a 14C age of 10,310 +/-150 yr. B.P. (BGS-1580) was found for an unidentified clamshell, which was found in the riverbed deposits at the north end of Niagara Glen (Tinkler *et al.* 1994).

Kindle and Taylor (1913) mapped the gorge from the Escarpment edge to the present Falls. In the section from the power stations to Niagara Glen, they mapped areas of silts on the top of the gorge, which were interpreted as wide river-lake bottom deposits. During the Main Algonquin level all of the other outlets, both west and east of the gorge, were probably periodically active, including the spillway through the present city of Niagara Falls, New York. This section of the gorge gets wider as you go south, and instead of narrowing due to gradually lower flows, it actually widens right up to its abrupt halt. This indicates that the flow from the upper Great Lakes ceased almost instantly in geological time, and perhaps also suggests that isostatic rebound was progressively closing the eastern outlets of Lake Tonawanda. This gorge was cut during the Palaeo-Indian time period; in fact, the dates given for this culture appear to match exactly the time frame for this section.

The area of the Niagara Glen (800 m) is the last section to be examined, and it appears that the change in cross-section size and configuration of the gorge is quite drastic. The ratio to the Upper Great Gorge is reduced to 0.87, and this likely includes a substantial fraction caused by gorge cutting, with the subsequent return of discharge close to the present volume. Approximately 60% narrower than the previous section, this area was cut by very reduced flows around 10,300 to 5,500 B.P. (Tinkler *et al.* 1994), which covers the Early and Middle Archaic periods. During this time, the Upper Great Lakes inflow to Lake Erie was cut off completely, and the climate seems to have been much drier and warmer than it is today (Sarvis, 2001). As a result, the amount of flow into Lake Erie from its tributary streams was only 13% of the outflow today (Tinkler *et al.* 1994) and the level of Lake Erie was also commensurately lower along its northern shore.

During the Palaeo-Indian and Early Archaic cultural periods, the Falls still had not cut through the Lyell/Johnson control sill. Why is this important? As long as the Lyell/Johnson sill provided the control, there was no drop in elevation of the Niagara River from Fort Erie to the Lyell/Johnson sill (172.3–173.2 m) in Niagara Falls. However, once the Lyell/Johnston sill had been breached, the Fort Erie sill (170 m) became the control, which caused the drop in elevation that exists today. The river initially has a strong current, as it drops from Fort Erie. The gradient is gentle around Grand Island, and then, because of a drop in elevation over the preglacial surface, the current increases again, becoming highly treacherous as it approaches the present day Falls.

During the Palaeo-Indian and Early Archaic periods, the outflow from Lake Erie placidly entered the Lake Wainfleet/Lake Tonawanda basin, with the currents remaining negligible until they approached the Lyell/Johnson sill. With Lake Erie, Lake Wainfleet, and Lake Tonawanda all at the same elevation, boat transport in any direction was not a problem. Furthermore, migrating animals were able to swim across at the narrow points; so it is likely that aboriginal kill sites also existed here at this time. In winter, the slow flow permitted early freezing of the surface and substantial ice thickness developed. Thus, it was possible to cross the river and lakes at many points.

Environmental Conditions and Changes

The years from 11,200 to 8,000 B.P., which covers the entire Palaeo-Indian and Early Archaic cultural periods, witnessed larger changes in isostatic rebound, temperature, vegetation and lake levels than any time since. Cores taken from peat bogs in the Niagara Peninsula (Pengelly 1990; Tinkler *et al.* 1992; Sarvis 1997, 2001) show that the vegetation changes mirrored changes taking place elsewhere in southwestern Ontario; however, there were minor differences due to the local vegetation around the core area.

Many detailed studies have addressed the post-glacial changes to the environment and vegetation that have occurred in southwestern Ontario, and these include the concise published works of Karrow and Warner (1990), McAndrews and Jackson (1988), and Pielou (1991). The following is a brief discussion of a few of the important issues contained within these reports.

From deglaciation until 12,500 B.P., the Niagara Peninsula had basically arctic, tundra-type vegetation with a cold, dry climate (Karrow and Warner 1990). The landscape was primarily an arctic desert, with very little snow. Remnants of ice blocks from the glaciers that had been buried by glacial lake sediments dotted the landscape as they slowly melted away to leave small depressions.

During the time period 12,500 B.P. to 10,500 B.P., open spruce parklands and later, closed spruce forests dominated the landscape. Precipitation was also heavier, with a notable increase in the amount of snowfall during the winter months and rain throughout the summer (Karrow and Warner 1990). Tinkler and Pengelly (1994) investigated the remnants of debris built up by protalus ramparts along the bottom of the Niagara Escarpment, between 12,500 B.P. to 10,000 B.P. When debris was released from the rock face, it slid down over the ice and snow that had accumulated along the northwest to northeast faces of the escarpment each winter, and over a prolonged period of time, resulted in the creation of the protalus ramparts. The northern slopes of the escarpment are in shadow for much of the year, and the surface debris would have also served to insulate the ice and snow, thus preventing it from melting. In general, the ramparts indicate that temperatures were still colder than today.

McAndrews and Jackson (1988) believe that proboscideans such as mammoth and mastodon were present during this time period and disappeared by 10,500 B.P. They also hypothesized that the extinction may have been due to the climatically induced succession of jack pine and hardwood forests and the drying up of wetlands. Most of the remains of mammoths found in Southern Ontario have been found on the plains along the north shore of

Table 7.1 Projectile Point Types Used During the Palaeo and Early Archaic Periods Found in Niagara

Type	Total	Percentage
Palaeo - Fluted Points	12	6.52
Hi-Lo	28	15.22
Early Archaic Side and Corner Notched	99	53.80
Bifurcate Base	45	24.45
	184	100.00

It is important to remember that these point types only represent 6.11% of the 2,995 points catalogued by James Pengelly in Niagara Peninsula Collections

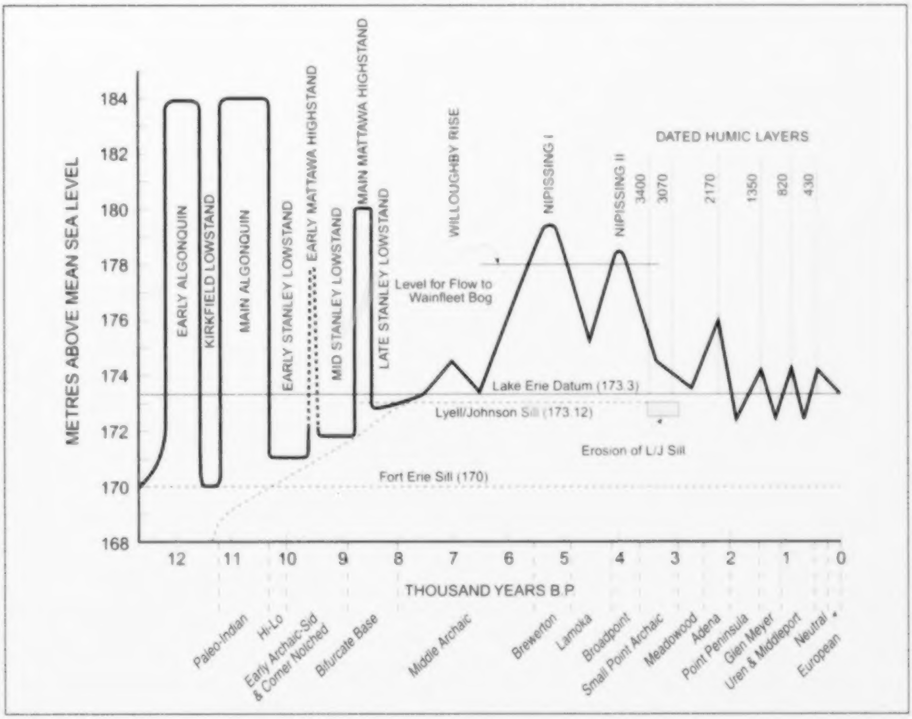

Figure 7.5 A Chronological Chart Comparing Lake Erie Lake Level Changes with Recognized Aboriginal Cultural Periods. The relationship between the Lyell/Johnson and Fort Erie/Buffalo sills is illustrated. It would appear that there is a strong correlation between lake level changes, perhaps driven by climate changes, and changes in cultural periods.

Table 7.2 Raw Materials Used During the Palaeo and Early Archaic Periods Found in Niagara

Type	Material Used	#	Percentage
Palaeo-Fluted Points 11,200–10,500 B.P.	Onondaga Chert	9	75.01
	Obsidian	1	8.33
	Coshocton Chert	1	8.33
	Ohio Chert	1	8.33
	TOTAL	12	100.00
Hi-Lo 10,500–10,000 B.P.	Onondaga Chert	9	32.14
	Haldimand Chert	9	32.14
	Goat Island Chert	5	17.86
	Bois Blanc Chert	3	10.71
	Mercer Chert	1	3.57
	Quartz	1	3.57
	TOTAL	28	100.00
Early Archaic Side and Corner Notched 10,000–8,900 B.P.	Onondaga Chert	64	64.65
	Haldimand Chert	9	9.09
	Goat Island	6	6.06
	Bois Blanc Chert	5	5.05
	Mercer Chert	4	4.04
	Flint Ridge Chalcedony	3	3.03
	Boyle Chert	2	2.02
	Quartz	2	2.02
	Jasper	1	1.01
	Wyandot Chert	1	1.01
	TOTAL	99	100.00
Bifurcate Base 8,900–8,000 B.P.	Onondaga Chert	44	97.78
	Goat Island Chert	1	2.22
	TOTAL	45	100.00

Local cherts identified by James Pengelly, exotics by Jack Holland

Lake Erie, below the Main Algonquin shorelines. However, perhaps it was not the drying out of the wetlands that killed them, but rather the flooding of the wetlands; as the variable water levels of the Main Algonquin rose in the very flat terrain, trapping the mammoths in the low-lying areas and closing off their means of escape. The two mammoth finds in the Lake Wainfleet area east of the Grand River were not found in peatlands – one was found in clay silt layers, and the other was in a sandbank in the Dunnville Delta.

By 10,500 B.P., pine dominated the landscape – first, jack and red pine and then later (by 9000 B.P.), white pine became the most prevalent. At the end of the Early Archaic period, about 8,000 B.P., the forests were mixed white pine and deciduous forest, similar to the type of vegetation that existed for the next 8,000 years. The climate was also comparable to that of today.

Archaeological Field Surveys

The Niagara Peninsula has not been blessed with very many organized field surveys over the years. Paul Lennox (1976), Chris Ellis (1977), Martin Cooper (1982) and James and Suzanne Pengelly (1984, 1985, 1986) all carried out field surveys in specific locales, mostly in areas of the Niagara Peninsula south of the Niagara Escarpment. Martin Cooper (1982), and James and Suzanne Pengelly (1984, 1985, 1986 and 1987) attempted to catalogue some of the hundreds of point assemblages found in collections and museums in Niagara; however, thousands more artifacts remain in the hands of local collectors. Fortunately, some of these people have been very co-operative over the years, allowing access to their collections and sharing knowledge of the sites where they gathered specific tools. The projectile point totals in Tables 7.1 and 7.2 are biased to a certain extent because collectors in the Niagara area often seem to search the same areas along the Welland River and tributary streams. However, the field surveys and specific site reports that were mentioned earlier, almost exclusively cover areas not along the Welland River, and this may help to reduce the bias. Unfortunately, only one Palaeo-Indian site in this area has had a cursory excavation and no sites of other time periods have had any controlled professional excavations.

Lake Level Changes and Changing Cultural Periods

Figure 7.5 shows the comparison between reported lake level changes and the recognized dates for aboriginal cultural changes, and this evidence reveals a strong correlation. Lake level rises usually reflect changing climate conditions, which can subsequently alter aboriginal site locations and the availability of food resources, forcing these cultures to formulate new strategies. Areas well known for their availability of certain resources could very well disappear, and it might take years or decades for plant communities to re-establish themselves elsewhere. With the exception of flooding induced by wind-set surges (Libicki and Bedford 1990) (two metres within a matter of hours), water level changes would likely have been gradual, measuring at the very most, only a few millimetres or centimetres per day. As a result, aboriginal groups would certainly have had ample time to move habitation sites. Although temporary coastline hunting and fishing camps would have been more vulnerable, they could have easily shifted and possibly re-occupied if levels subsequently dropped.

Mercury Poisoning?

James Bay Example & Bioaccumulation

Lake level flooding likely caused other problems for the aboriginal occupants, problems that would not have been easily recognized or associated with floods, such as mercury poisoning of food resources and ultimately, people (Tinkler and Pengelly 1995). In a contemporary example, flooding in northern Quebec associated with the development of the huge James Bay HydroElectric complex has resulted in increased mercury levels within the reservoirs and consequently, in the associated plant, animal and human populations. Populations that obtain most of their food resources from terrestrial plant and animal sources (deer, elk, caribou) would have considerably lower risks of encountering mercury as those more reliant on aquatic food resources. In the area flooded by the James Bay Hydro project, studies have found that people described as trappers by the aboriginal community had consistently higher concentrations of mercury in their bodies. While these people may have been consuming more fish, it is also likely that any of the animals they trapped, which fed on fish or aquatic plants, would have been a source of the mercury. Birds that eat fish or aquatic plants have heavier concentrations of mercury, and mercury can also be obtained by drinking contaminated water (Dumont 1995). Bioaccumulation of mercury indicates that high levels of mercury are present in species that are higher in the food chain. Humans, at the top of the food chain, would get the biggest dose.

Production of free mercury

The source of the mercury is from vegetation inundated by flooding and decomposing underwater. This process releases bacteria that in turn, produces methyl mercury. The methyl mercury is taken up during feeding by aquatic vegetation and animals, thus contaminating them. Bioaccumulation of mercury results in increasing amounts of mercury in animals higher up in the food chain. While the submerged terrestrial vegetation responsible for the mercury increases, may be completely removed from the system in 10 to 20 years, bioaccumulated mercury can remain in fish and amphibian populations for upwards of a hundred years.

Consideration of early Lake Erie conditions

In the case of the Algonquin, Mattawa and Nipissing Rises, probably hundreds of thousands of square kilometers of vegetated and forested land was flooded. The conditions for increased mercury levels would have arisen after each flood. The time between the major floods (up to several decades) would have been sufficient to allow reforestation to take place on the newly drained lake bottoms and replicated conditions for additional contamination during the next flood. As well, some downstream transport of mercury through the Great Lakes system may have occurred, giving Lake Erie an enhanced dose of methyl mercury. As a consequence, Aboriginal groups in the eastern Lake Erie basin, depending on their reliance on aquatic foods, would have been exposed to increasing levels of naturally occurring mercury after every new flooding.

Symptoms and impact of mercury on Late Palaeo-Indian, Early Archaic groups

Symptoms of mercury poisoning include short-term memory deterioration, introverted behaviour, irritability, loss of hand-eye coordination and physical exhaustion. Child development in particular is negatively affected. Overall, number and severity of symptoms increase with exposure and dosage (Needleman 1995). In all cases, these symptoms are contrary to those required for individual and group survival in a prehistoric context. In a population that requires good health, a keen mind, good reflexes and close social ties in order to supply the necessities of life in the harsh environment of the Palaeo-Indian and Early Archaic Periods, the effects of mercury poisoning would be catastrophic. Specifically with regard to stone tool production, symptoms of mercury poisoning would have precluded any ability to produce functional projectile points. Ellis, Kenyon, and Spence (1990) note that there is a decrease after Palaeo-Indian times, in the care and skills lavished on the production of chipped stone tools during the Early Archaic period. Based on the environmental inference described above, one hypothesis regarding this decline may be based in mercury poisoning of the population to a level where knapping skills were adversely affected.

Projectile Points and Chert Resources

Three main kinds of chert are available in the Niagara Peninsula and these include Bois Blanc chert, Goat Island, and the most important, Onondaga chert. Bois Blanc chert is available at localized spots in the Onondaga Escarpment. Although glacial lake sediments cover most of this escarpment, in the Port Colborne and Ridgeway areas there are some outcrops. This escarpment was always above every lake level rise. Goat Island chert is available in the Niagara Escarpment, which was also not affected by any of the lake level rises. Onondaga chert, the most utilized material, is not available in exposures of the Onondaga escarpment since the glaciers overrunning the Escarpment removed it from its uppermost position (Parkins 1977). However, exposures of Onondaga chert can be found along the north shore of Lake Erie, especially on the headlands and on the beaches immediately east of each headland (Parkins 1977). Another source is the mouth of the Niagara River at Fort Erie. Onondaga chert is also available in the Onondaga escarpment in New York State (Parkins 1977). Because Onondaga chert beds along the north shore of Lake Erie are almost at present day lake levels, any rise in water levels above modern levels would have made this resource unavailable (Pengelly and Tinkler 1995). This is the case most particularly, at the lake levels of 183 to 184 m (Tinkler *et al.* 1992), which were found during the Main Lake Algonquin and the 180 m Mattawa high stands (Pengelly *et al.* 1997) at a later period. Haldimand chert is available in the Onondaga escarpment in Haldimand County, west of the Grand River, especially west of Cayuga (Parker 1986). One natural process could make Onondaga chert available at higher levels in the Niagara peninsula during the Palaeo and Early Archaic periods, and this is the movement of chert from the beds along the lake to higher ground landwards by ice rafting.

Ice Rafting Processes

Archaeological field surveys in the early 1980's in the Wignell Drain area of Port Colborne, Ontario on the southern edge of the Niagara Peninsula, led to the discovery of numerous multi-component archaeological sites (Pengelly and Pengelly 1984, 1985, 1986). While some of the sites are discrete clusters of Onondaga chert blocks, cores, flakes and tools, other areas are more puzzling and consist of many hectares of continuously exposed Onondaga chert, blocks, cores, flakes and tool manufacturing waste. The Port Colborne Quarry site (AfGt-58), one the richest sites, is actually a fifty-hectare farm. The boundary fences were used to delineate the site area, although chert concentrations at this site extend into neighbouring fields.

The sediment in the area is mainly glacial and post-glacial lacustrine clay silt. However, a sand deposit, probably the remnant of a sand bar formed in the highest levels of Lake Erie during the Main Lake Algonquin rise, runs from west to east across the site. This sandy area has the heaviest concentration of chert, with up to 50% of the sediment composition in some locales. The chert flakes in this area are so thick that the ground crunches with chert rubbing against chert as you walk over it. The closest outcrop is found along the present Lake Erie shoreline 4 km to the south of the site. There are no Onondaga chert outcrops within the Wignell Drain basin.

The initial hypothesis on the origin of the chert was human transport. This was quickly rejected due to the massive and widespread quantities of chert. It was also hypothesized that the chert was raised to the surface, by frost action acting on underlying chert beds. Recent excavation of a water pipeline from west to east across the Wignell Drain basin discounted the frost action hypothesis. The digging of a 3-m deep trench revealed that chert appears only in the top 0.5 m of soil and that the sediment cover over the bedrock is up to 3 m. deeper than anticipated. The stratigraphy led to a new hypothesis for the chert deposition – that it was the result of ice rafting of material from the chert exposures along the present day shoreline to the site during the Main Lake Algonquin lake level on Lake Erie.

This type of transport still takes place today along the Lake Erie shoreline. Winter ice that forms on the lake surface is driven and rafted onshore by prevailing southwest winds, and afterwards, loose chert blocks can be found abundantly on the beach (Stephen Douglas, personal communication, 2001). This process might have transported chert to the upper levels of the Wignell Drain, into areas of Lake Wainfleet (Ellis, 1977) and also potentially to Lake Tonawanda. Gravel in the Niagara Glen area of the Niagara Gorge reveals abundant Onondaga chert pebbles (Tinkler *et al.* 1994).

The Lake Erie shoreline, from the Grand River east to the Niagara, consists of a series of bedrock headlands interspersed with scallop shaped bays. These bays are usually sites of sandy/gravely beaches, with gravel found closest to the headlands and sand being more predominant as you get farther away from the headland. The main erosive processes that affect the point and bedrock in the shallow water offshore take place during the winter and early spring. Water in the shallow bay freezes from the surface to the bottom, into the many cracks in the bedrock and between the bedding plains of the chert-bearing sedimentary rock. The freeze/thaw cycle may happen several times during the winter and spring. Ice starts to form in December, continues to accumulate during January, and reaches the maximum thickness by late February and early March. As long as the cold weather is continuous and no major winds cross the lake, very little ice movement takes place; however, if a prolonged thaw occurs, the ice starts to crack and shift. If this is accompanied by a strong wind over the lake the ice moves, which causes the ice to be pushed onto the shore forming an ice foot.

Offshore, the movement pushes up ice windrows, which can reach up to 10 m high. A series of storms in the spring can cause ice to be pushed onshore, and as the ice begins to melt it drops its load of chert cobbles, limestone and sand onto the beach. During the Algonquin and Mattawa highstands, the winters were much longer and cooler than present, and as a result, the lake would have frozen deeper for longer periods. The outflow of water from Lake Agassiz would have been at its highest during the summer months, but it would

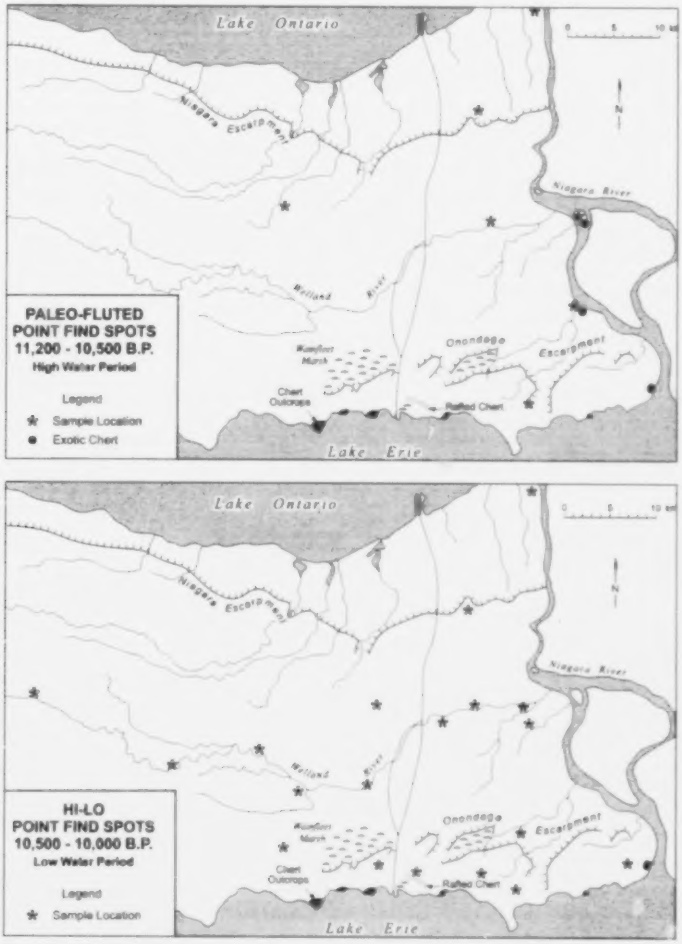
Lake Ontario
0 5 10 km
N
Niagara Escarpment
Niagara River
Welland River
PALEO-FLUTED
POINT FIND SPOTS
11,200 - 10,500 B.P.
High Water Period
Legend
Sample Location
Exotic Chert
Wainfleet Marsh
Chert Outcrops
Onondaga Escarpment
Rafted Chert
Lake Erie
Lake Ontario
0 5 10 km
N
Niagara Escarpment
Niagara River
Welland River
HI-LO
POINT FIND SPOTS
10,500 - 10,000 B.P.
Low Water Period
Legend
Sample Location
Wainfleet Marsh
Chert Outcrops
Onondaga Escarpment
Rafted Chert
Lake Erie

Figure 7.6a, b (a) Palaeo: Fluted: point find spots 11,200–10,500 B.P. (b) Hi-Lo: point find spots 10,500–10,000 B.P.

have taken time for this surge of water to affect the level of Lake Erie. Tinkler and Pengelly (1995) modeled the flow of water from Lake Agassiz to Lake Erie and found that peak flow would most likely affect Lake Erie in the early spring of the next year. The subsequent rise in the lake level, and the wind rafting of ice floes would have carried the chert cobbles and limestone inland in incremental steps, to the 183–184 m level. Phillips (1993; 1988) mentions that the same processes have taken place on archaeological sites found along Lake Minong shorelines near Thunder Bay, Ontario.

We hypothesize that this is the main reason for the large chert concentrations found by Ellis (1977) in the low-lying areas of Wainfleet Township area. Aboriginal groups, utilizing

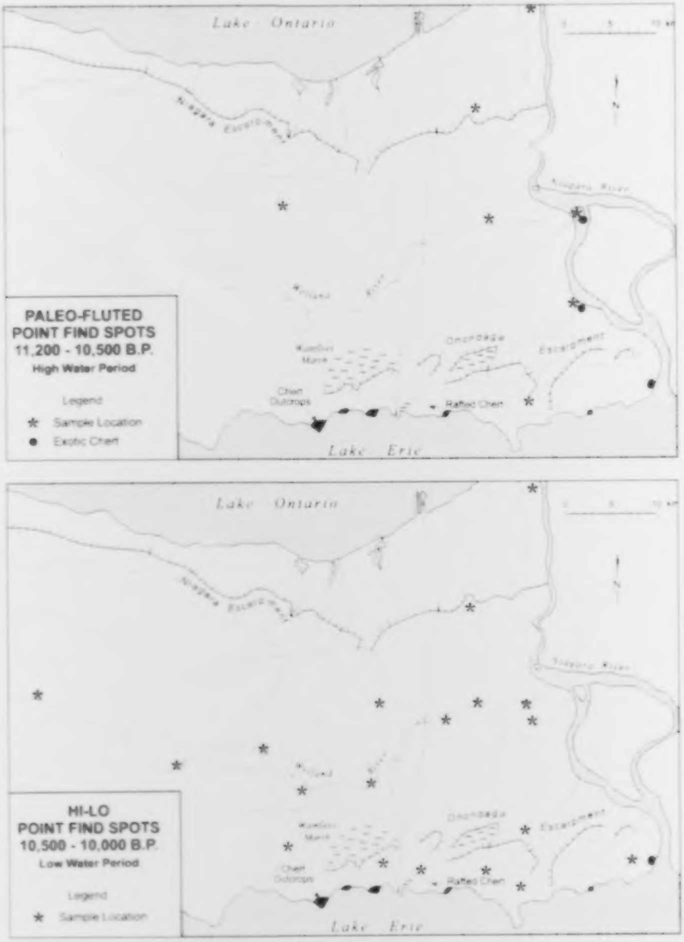
Lake Ontario
Niagara Escarpment
Niagara River
Welland River
Onondaga Escarpment
Wainfleet Marsh
Chert Outcrops
Rafted Chert
Lake Erie
PALEO-FLUTED
POINT FIND SPOTS
11,200 - 10,500 B.P.
High Water Period
Legend
★ Sample Location
● Exotic Chert
HI-LO
POINT FIND SPOTS
10,500 - 10,000 B.P.
Low Water Period
Legend
★ Sample Location

Figure 7.6a, b (a) Palaeo: Fluted: point find spots 11,200–10,500 B.P. (b) Hi-Lo: point find spots 10,500–10,000 B.P.

have taken time for this surge of water to affect the level of Lake Erie. Tinkler and Pengelly (1995) modeled the flow of water from Lake Agassiz to Lake Erie and found that peak flow would most likely affect Lake Erie in the early spring of the next year. The subsequent rise in the lake level, and the wind rafting of ice floes would have carried the chert cobbles and limestone inland in incremental steps, to the 183–184 m level. Phillips (1993; 1988) mentions that the same processes have taken place on archaeological sites found along Lake Minong shorelines near Thunder Bay, Ontario.

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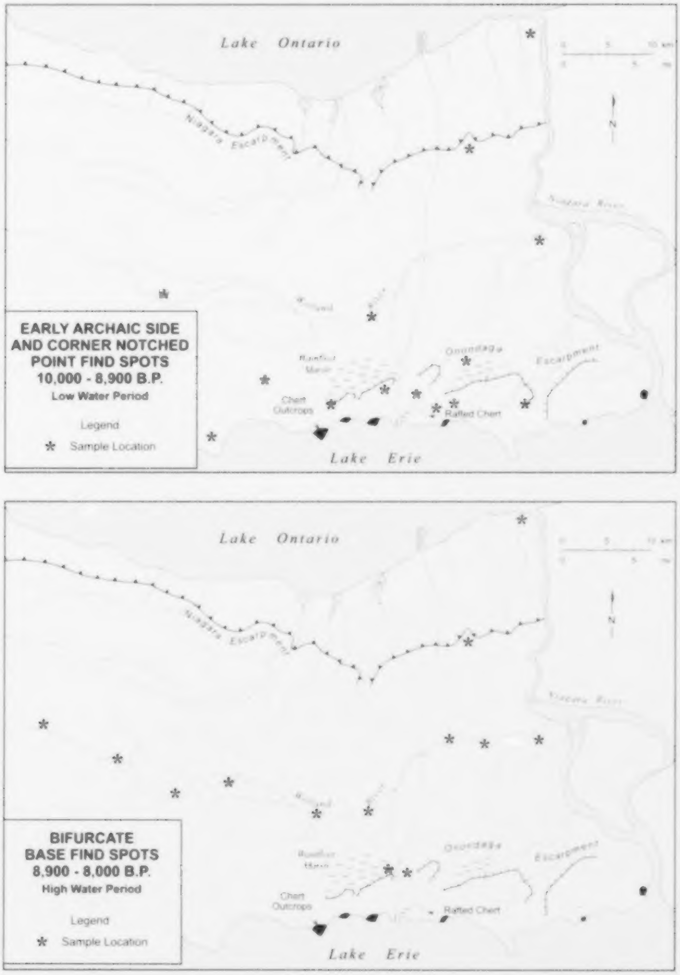
Lake Ontario
Niagara Escarpment
Niagara River
N
0 5 10 km
EARLY ARCHAIC SIDE AND CORNER NOTCHED POINT FIND SPOTS
10,000 - 8,900 B.P.
Low Water Period
Legend
* Sample Location
Onondaga
Escarpment
Chert Outcrops
Rafted Chert
Lake Erie
Lake Ontario
Niagara Escarpment
Niagara River
N
0 5 10 km
BIFURCATE BASE FIND SPOTS
8,900 - 8,000 B.P.
High Water Period
Legend
* Sample Location
Onondaga
Escarpment
Chert Outcrops
Rafted Chert
Lake Erie

Figure 7.7a, b (a) Early archaic: side and corner notched point find spots 10,000–8,900 B.P. (b) Bifurcate Base: point find spots 8,900–8,000 B.P.

the least amount of effort for the maximum amount of gain, did not mine chert from the bedrock points, because this is a difficult feat, even with modern tools. Instead they picked up either ice-rafted chert cobbles and limestone hammerstones found on the beach east of each of the headlands, or the deposits carried further inland by ice-rafting, and worked them on site, carrying away either the finished products or biface tool blanks. Evidence for this type of behaviour can be found in the sand dunes along the lakeshore. It is not unusual to find heavy concentrations of chert flakes several centimetres deep within the stratigraphy of the dunes.

Locations of Point Finds By Types

It is important to stress that the locations mapped in Figures 7.6 and 7.7 are find spots and not excavated sites. Sometimes the location means that only one point was found, and at other times a location signifies the discovery of a dozen or more points. Most of the locations represent multi-component sites used over and over again for thousands of years.

Palaeo fluted points (Figure 7.6a; Table 7.1; 11,200 to 10,300 B.P.) numbered only a few, as would be expected with a small hunting population in the Niagara Peninsula at this time. The formation of Lake Wainfleet limited the availability of site locations to areas above 184 m, leaving only a small amount of the land in the southern Niagara area. Out of a total of twelve points (Table 7.1), two of the points, both Gainey type and made from Onondaga chert, were found on the shorelines around Lake Wainfleet. Eight points were on sites north of the divide that kept Algonquin waters generally confined south of the area. Six of them are north of the Niagara Escarpment. Two points, made of both Gainey and Onondaga chert, were found at a site that had a very cursory archaeological excavation. The site was found on a bench located just above the water level of a creek that would have been affected by any overflow of water at the THB outlet during the Main Algonquin rise. Four points made of Gainey and Onondaga chert were found at one site below the Niagara Escarpment above the Lake Iroquois shoreline, and another similar point was found on the Lake Iroquois lakebed. Finally, three points manufactured from exotic cherts not found in the area, were located at two sites below 184 m., which were zones of sediment deposition under Main Algonquin lake levels. The water depth over both sites was probably less than two metres. The finds, one on Navy Island and one at Black Creek, were located at the places where narrowing of the Niagara River occurs. These may have been kill sites where animals such as Caribou crossed the river, but it is also likely that the points were removed by erosion from other areas and dropped here. The fact that all three points were manufactured from exotic cherts, one obsidian, one Mercer chert and one unidentified material, but probably chert from the Pennsylvania/Ohio area (Rolly Nafur, personal communication), suggests that perhaps they were left by early migrants or travelling hunter groups passing through the Niagara Peninsula. All three of these points are Gainey type. The fact that all the points, except for the three found in Algonquin sediments, were located above the 184 m level of Lake Wainfleet or north of the controlling divide would seem to indicate that the lake level was the controlling factor in site location. However, since the Onondaga chert beds along Lake Erie were at that time under at least 10 m of water, where did these populations obtain their Onondaga chert? This type of chert is available in western New York State (Parkins 1977); so perhaps the Niagara Palaeo populations were only transitory occupants, stopping on their migratory rounds as they followed the caribou herds from eastern or southern areas to areas further north in Ontario.

Hi-Lo points (Figure 7.6b; 10,300 to 10,000 B.P.) are predominantly (96.43%) cherts or materials that can be found in southern Niagara or within reasonable walking distances of the Niagara area. Only one, made of Mercer chert and available south of Lake Erie, is exotic to the area. Lake levels were at or below present lake levels, so the drainage systems would have been similar to today. The drained Lake Wainfleet lakebed would have contained a few boggy locations, areas of cattail marshes, and abundant grass and scrub growth, as the trees tried to reforest the new land. Temperatures were higher than the earlier Palaeo period and precipitation was less. Find spots are still scarce but more abundant than the earlier period. Only four finds are located on the former lakebed and the rest are found on higher ground or north of the Fonthill Kame/Delta divide. Nine (32.14%) of the finds are located along the Welland River, but on the high ground; and six (21.43%) are south, but above the Lake Wainfleet shoreline. In total, fifteen (53.57%) are around the Lake Wainfleet shoreline. There may be two possible reasons for this bias. Firstly, the three hundred-year time period for this point type was not enough time for the aboriginal population to forget the old water levels and abandon sites that were above the high levels of former times. Secondly, locating sites on abandoned shorelines would allow the population to access resources in three ecological zones, which include the forests above the areas that were flooded, the river, and the grasslands and marshes on the abandoned lakebed. The real reason was most likely the latter, but with a little bit of caution from the first.

Early Archaic, Side and Corner Notched finds (Figure 7.7a; 10,000 to 8,900 B.P.) are the most abundant of the four time periods studied, but the find spots are no more abundant than in the Hi-Lo period. The biases of the earlier Hi-Lo period are still present, with most sites being located above Algonquin levels. The Welland River is still a preferred location, probably for the same reason: exploitation of more than one ecological zone. Many finds were made in areas that had abundant deposits of ice-rafted Onondaga chert, indicating that they were exploiting these resources, even though the Onondaga chert beds found along the present Lake Erie were also available. Lake Erie levels were still similar or below present levels. There may have been an Early Mattawa high stand during this period but this is questionable at this time, and perhaps this is the reason for the exploitation of the ice-rafted chert deposits.

Bifurcate base point finds (Figure 7.7b; 8,900 to 8,000 B.P.) are about half of those found during the earlier period. The majority of the finds were made along the Welland River above 180 m, and two were above the Lake Wainfleet southern shoreline. The Mattawa rise once again caused the formation of Lake Wainfleet to a level of 180 m. All the sites were above this level, and all the finds were made on multi-component sites. Every one of the points were made of local cherts, Onondaga represented (97.78%; Table 7.2), but once again the Onondaga chert beds along Lake Erie were under about 7m of water. If they were utilizing the ice-rafted chert deposits, it is not evident from finds in these areas; so perhaps they were utilizing sources in western New York State.

Conclusion

Love of birthplace, no matter how inhospitable it may appear to strangers, is quite possibly a universal characteristic. (Bennet et al. 1978)

This land is where we belong – it is God's gift to us and has made us as we are. This land is where we are at home, we know its way: and the things that happen here are known and remembered, so the stories the old people told are still alive here. This land is needed for those who will come after us. This land is the place where we know to find that is provided for us – food for hunting and fishing and farms, building and tool materials, medicines. Also the spirits around us know us and are friendly and helpful. This land keeps us together. (Goldsmith and Hildyard 1984)

These quotes reflect the bond that people, especially aboriginal people, have for the land that they occupy. Therefore, the possibility of having to move out of a known territory and known subsistence patterns into a new and unknown area, was capable of causing social upheaval and stress in the people affected. During the last 12,000 years the aboriginal populations of the southern Niagara Peninsula have been forced to relocate their resource exploitation territories several times due to rising lake levels (Fox and Pengelly 1990). Consequently, they had to change the kind and amount of animal, fish and vegetation items used in their diet, and most likely there were times of abundance as well as times when food was very scarce. An exception was the colonizing Palaeo-Indian period when the find sites were isolated from later multi-component sites, and they also appeared to be transitory in nature. It would seem that for later cultures, a fondness for known areas of land and known exploitation zones, no matter what the conditions, were the determining factors. Sites were used over and over again for generations. The only other factor that changed may have been the interaction with groups further away. The Early Archaic side- and corner- notched time period had the most exotic chert points, mainly from Ohio and Pennsylvania, which perhaps reflects increased contacts with these areas. Later periods had very few exotic chert points, which may indicate that the focus during these times was on being completely self-sufficient and having contact with only local known groups. It could also reflect that in the Hi-Lo period when the land was newly drained, and in the Bifurcate period when the land was being flooded again, the time required to procure food resources was so excessive it did not allow time for more social contacts.

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8.

Archaic Reoccupation of Late Palaeo-Indian Sites in Northwestern Ontario

Andrew Hinshelwood

Abstract

Abandoned shorelines of post-glacial Lake Minong and outcroppings of Gunflint Formation taconite (chert) are associated with a significant archaeological site complex at Thunder Bay, Ontario. Shoreline location of sites, supported by a limited amount of geoarchaeological research, and a handful of typologically identifiable projectile points and radiocarbon dates, has placed the initial regional occupation to 9,400 to 9,600 B.P. Locational association between cultural materials and abandoned shoreline features is clear; however the interpretation of this association is often overextended. That the sites are located upon the abandoned beaches is demonstrable, but relatively little work has been completed to confirm the contemporeneity of the sites and beaches. Ongoing survey of shoreline associated with sites in and around Thunder Bay has resulted in the recovery of diagnostic Archaic artifacts intermixed with presumed earlier materials. Slow rates of boreal forest soil development and natural disturbance from forest fire and windthrown trees are considered the basis for the intermixing. Local conditions at and near the sites argue for their continued use. First, the coincidence of good quality toolstone adjacent to the abandoned shoreline features ensures the continued use of the sites for quarrying and primary reduction as long as local populations are familiar with the outcrops. Secondly, as the post-glacial lake retreated after 9,400 B.P. the high, well-drained shorelines would have remained convenient and comfortable for habitation and travel, even as they were located at increasing distances from the active lake shore. Future inventory research in the Thunder Bay area needs to focus less on the large shoreline sites and increasingly on the smaller sites where either the shoreline or the bedrock outcrops are absent.

Résumé

La phase récente du Complexe paléoindien Lakehead est associée aux traits caractéristiques des zones côtières abandonnées et à l'exposition superficielle du soubassement contenant le

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materiel lithique « Gunflint Formation ». La date de l'occupation initiale à Cummings (DcJi-1) calibrée par Julig, *et al.* (1990) établie que l'emplacement de cette occupation était située sur les zones côtières postglaciaires qui était actives. Phillips et Hill (ce volume) fournissent l'évidence qu'il y avait d'autres occupations appartenant à une période précédente vers le sud de cette région. Cependant, les sondages exploratoires ainsi que les interventions archéologiques qui se déroulent sur les sites du Complexe Lakehead démontrent que l'occupation a persistée encore longtemps suivant l'abandon de ces zones côtières lorsqu'elles était à l'intérieur des terres, au loin des grandes étendues d'eau. L'utilisation continuelle des sites précédents sur ces zones côtières par les populations appartenant à la phase récente de la période paléoindienne ainsi qu' à la période archaïque pour l'intention d'y obtenir les matériaux lithiques est souvent obscurée par les chercheurs qui fixent l'attention sur l'occupation des zones côtières et sur la date relative à l'occupation « la plus ancienne ». Lorsqu'on examine les sites régionaux du Complexe Lakehead conjointement, on obtient une meilleure représentation de cette occupation postglaciaire. Cette revue suggère que les matériaux lithiques étaient vraisemblablement l'attrait principal des groupements humains dans la région Lakehead, et que, suivant le début de l'abandon des zones côtières, la disponibilité des ces matériaux lithiques de haute qualité peut avoir augmentée.

Introduction

The Late Palaeo-Indian Lakehead Complex of western Lake Superior shows a strong association with abandoned shoreline features of glacial Lake Minong and surface exposures of Gunflint Formation (taconite) bedrock. Regional occupation has been dated relative to Lake Minong, and provides for initial occupation no earlier than 9,600 to 9,400 B.P. After 9,400 B.P. rapidly declining water levels in the Superior basin would have isolated the sites in interior locations. Excavation at the Cummins site and the general distribution of late Palaeo-Indian artifacts support the use of active shorelines between 9,600 and 9,400 B.P. Archaic artifacts (corner-notched points and one copper point) present on the abandoned shoreline features and at lower elevations, suggest the continued use of these locales for lithic procurement after shoreline abandonment. The regional archaeological literature has presented the association between late Palaeo-Indian sites and shoreline features as the key attribute in both defining the Lakehead Complex and in dating occupations. By stressing this association, survey work directed towards the identification of additional sites has been very successful. However, once the sites are identified, they are not usually subject to more detailed studies of site chronology and material culture.

In reviewing site distributions within the Lakehead Complex area, it is clear that the role of abandoned shoreline features in determining occupation is masked by the juxtaposition of these features and Gunflint Formation outcrops. Late Palaeo-Indian material culture is focussed on biface production using locally quarried material and, as is typical of primary reduction sites, debitage is abundant. As a result, the larger sites on the well-drained shoreline features are relatively easy to find. However, the overall distribution of sites and material suggest that these locales were also occupied as interior sites following the retreat of the active shoreline to lower elevations. Additional quarry locales were available to later occupants of the sites at elevations below the abandoned shorelines of Lake Minong. This suggests that rather than the active shoreline, it was the lithic resource that was the primary attraction to occupation of these sites throughout the late Palaeo-Indian and Archaic periods. In turn, this suggests that the role of the site/quarries in the economy of the late Palaeo-Indian groups may have remained important even as the local forest environment was changing. For the Archaic groups the lithic resource would have provided an added enticement to occupation beyond the emergent landscape and its subsistence potential.

Regional Deglaciation Chronology

The initial date for human occupation in the Lakehead area is constrained by the timing of the Marquette readvance, which concluded about 9,600 B.P. (Drexler *et al* 1983; Clayton 1983). Catastrophic discharge from Agassiz into Superior post 9,600 B.P. resulted in transgressive episodes during which beach deposits were reworked (Teller and Thorleifson, 1983; Teller 1985). The principal level for post-glacial Lake Minong appears to have been achieved and stabilized between 9,600 and 9,400 B.P. (Julig, *et al.* 1990; Clayton 1983). Julig *et al.* (1990) report water worn artifacts in reworked beach deposits at Cummins and on this basis provide an initial date for human occupation of about 9,500 B.P. Some evidence may exist for earlier entry southwest of the Lakehead (Phillips and Hill, this volume; McLeod 2001).

Between 9,500 and 8,000 B.P. the landscape appears to have changed rapidly. After 9,400 B.P. water levels in the Superior basin dropped rapidly. Along the north shore of Superior levels went from +/- 260m asl at 9,600 B.P. to +/- 105m asl at the time of the Houghton low phase, around 8,000 B.P., (Farrand 1960; Burwasser 1977) exposing a broad lacustrine plain. During this period, the glacial margin retreated north, and by 9,000 B.P. the ice margin formed the northern shore of glacial Lake Ojibway. By 8,000 B.P. almost all of northern Ontario, except the Hudson's Bay Lowlands, was ice and water free (Dyke and Prest 1987; see also Hamilton, this volume, for timing of human occupation further north). Changes in forest cover through the period 9,500 to 8,000 B.P. also saw a shift from open to closed spruce forest and, with climatic warming and colonization of pine, a transition to a closed, pine dominated forest (Amundsen and Wright 1979; Bjorck 1985; McAndrews 1982). Bjorck (1985) notes that while the early Holocene changes in forest composition were generally time transgressive from south to north, local areas saw this transition from spruce to pine dominated forest later than others (Julig *et al.* 1990; McAndrews 1982). This would mean that the transition was patchy, with pine regeneration occurring on optimal sites following disturbance such as forest fire, and spruce persisting in the absence of disturbance or on sites suitable for both species.

During the Hypsithermal it is expected that changes to local hydrology would also have affected local and regional land use patterns. The drying trend of the period could have led to the reduction in flow in many streams to the point where they became ephemeral or dried up completely. Plant species would have changed to reflect the reduced site moisture, which in turn would have had an impact on dependant fauna. Coupled to this would have been an increased ability on the part of the human population to move overland through formerly moist to wet inland areas during the summer months.

Perhaps the most significant aspect of the declining water levels in the Superior basin is the rate at which the shoreline sites of 9,500 B.P. became isolated interior locales. At Biloski, for example, it was estimated that the shoreline was active for only about 100 years. As the water levels declined, the active shoreline would have been moving away from the site at an estimated average rate of 4 or 5 metres each year (Hinshelwood and Webber 1986). The annual increment does not seem great, but several conditions would limit the appeal of the emerging shoreline. The exposed lacustrine plain would be thick with alder and willow, with moist to wet soils near the shore. The rate of emergence would be slow enough that shrub colonization would continue to the active shore. As well, the flat land surface would result in a water margin that was relatively featureless. Longshore travel would not necessarily be aided by watercraft, as depths near the shore would be insufficient for most craft save near the mouths of the larger streams. This is not to say that the active shore was completely uninhabited, as archaeological recoveries from lower elevations are reported (cf. Tanton 1931; Hinshelwood 1989; Dawson 1966). However, longshore travel would have been easier along the elevated, well-drained and lithic raw material rich strandlines inland from the active water margin. The appeal of these features for travel and occupation would have been enhanced by the presence of running water at stream crossings and may have been further heightened by the poorly-drained and densely forested areas further into the interior.

The Lakehead Complex

The Late Palaeo-Indian Lakehead Complex in northwestern Ontario is simply defined. Lakehead Complex sites are aceramic sites positioned at or above the elevations typical of the post-glacial Lake Minong strandlines. These would have produced plano or lanceolate bifaces or, as is more typically the case, early stage bifaces and quantities of debitage reflecting bifacial reduction of the locally outcropping Gunflint Formation taconite and cherts (Fox 1975, 1977a; Julig 1994). Ross (1995) has argued that the regional late Palaeo-Indian complexes should be considered to be local expressions of a larger regional late Palaeo-Indian "Interlakes Composite." Other complexes in the Composite include the Reservoir Lakes Complex to the south (Steinbring 1974; Harrison *et al.* 1995), the Quetico/Superior Complex immediately west of the Lakehead (Fox 1977a; Nelson 1992), and the Lake of the Woods/Rainy River Complex further west (Reid 1980; Haywood 1989).

The discussion that follows reviews the characteristics of some aceramic sites possessing some or all of the characteristics of Lakehead Complex sites. By considering shoreline association, the use of taconite raw material in lithic reduction, and the presence of late Palaeo-Indian plano, we can look at these locales and assess the contribution of each of these factors to the definition of a late Palaeo-Indian site.

Shorelines

Palaeo-Indian archaeology in the upper Great Lakes region has long been guided by the use of abandoned shoreline features as spatial and temporal landmarks (see Quimby 1960; Mason 1981). The coincidental occurrence of distinct topographic features and archaeological sites has been useful in establishing clear temporal relationships between sites, determining general dates prior to which site occupation was impossible, and in prospecting for additional sites. Quimby (1960) formalized this association for the western Great Lakes by identifying the early regional occupations as part of an "Aqua Plano" culture. In the western Lake Superior basin, Phillips (1982, 1988, 1993; Phillips and Hill, this volume) has conducted extensive fieldwork and analysis of post-glacial shoreline formation and abandonment, and the relationship between these features and early human occupation.

While post-glacial lake levels have been used to establish initial dates for regional occupations, and has allowed some speculation on the possible palaeogeography of the area at that time, the principle benefit of the association between sites and strandlines appears to have been to archaeologists surveying for additional sites. With an increasing shift from academic to entrepreneurial research, especially with regard to archaeological assessment and predictive modelling projects, the association between strandlines and archaeological sites has come to be more strongly stated in the "grey" literature than the data might support. Research confirming the direct association between artifacts and active shorelines is limited. For the Lakehead Complex sites, only work by Julig (1994; Julig *et al.* 1986, 1990) has been directed to gathering evidence of archaeological occupation of the active lake margin. Julig's findings at Cummins showed that deposits near the surface of the mineral soil were mixed. Deeper in the soil profile, reworked deposits containing water- worn artifacts showed that the active shoreline had been occupied and that transgressive lake levels had reworked the beach.

While it is clear that late Palaeo-Indian people occupied the active shores of post-glacial Lake Minong, the key landscape associations of interior sites remain enigmatic. Identifiable or suspected late Palaeo-Indian materials recovered away from the post-Minong shorelines, show a weaker correlation with lacustrine landforms and stronger associations with end moraines, modern topography, and bedrock outcrops. The Crane site (DcJj-14), is especially unusual, located on level terrain above the post-Minong elevation but away from any remarkable landscape features (Ross n.d.). One sub-regional exception is found in McLeod and Phillips's research south of Thunder Bay (McLeod 2001; Hamilton 2000; Phillips and Hill, this volume). Within this area of complex upland topography, a pattern is emerging of many short-term occupations at various elevations on the shorelines of ephemeral lakes created by ice damming.

Lithic Raw Material

Lakehead Complex sites are also, by definition, almost exclusive in their use of the locally available Gunflint Formation taconites in tool production. Lithic raw material is usually greater than 95% taconite (Fox 1975, 1977a). Lithic reduction patterns show the reduction of blocky or tabular cores of bedrock source material to bifaces. Platform preparation is often observed on debitage and edge grinding as platform preparation occurs on early stage bifaces (Hinshelwood and Webber 1987; Julig 1994). A range of implements typical of late Palaeo-Indian toolkits are present within the Lakehead Complex as a whole, but are less well-demonstrated at individual sites.

Taconite is the name commonly used for a red variant of the iron rich cherts, found within the sediments of the Gunflint Formation. It is a sedimentary rock composed of rounded bodies of iron-bearing minerals with some chert (Pye 1968), which gives the material a distinctive granular appearance, with colours ranging from "jasper" (red) through to black. Gunflint silica is also a Gunflint Formation chert, and is visually distinguished from taconite by its grey translucent appearance with fewer granules present. Kakabeka Falls chert is another form of raw material from the Gunflint Formation. This material is visually distinct from either taconite or gunflint silica by its thin sedimentary pattern of chert alternating with less cherty carbonate rock. In the younger Rove Formation which overlays the Gunflint Formation in many places, no chert is evident, but massive siltstone and greywacke is present in thick layers (Pye 1969). The Sibley Group, the upper bedrock unit east of the main Lakehead Complex area, contains reddish shales and dolomites, (Pye 1969) that are occasionally used in tool production (Hinshelwood 1990). Hudson Bay Lowland chert is an inclusive term used to describe cherts of variable colours that are obtained or, at least expected to be obtained, from cobbles within glacial drift deposits.

The coincidence of significant outcroppings of the Gunflint Formation with the post-Minong beaches created a fortuitous availability of a superior raw material at preferred occupation locales. Dawson (1983) originally suggested that the "rock knob" at Cummins was the principle source of the taconite at the site. Investigations at the rock knob at other parts of the site revealed relatively little in the way of red, high quality taconite here or at higher elevations. However, the beach at Cummins appears to have been formed over a series of "steps" in the bedrock (Phillips 1988; Julig 1994). Recent survey work in the Cummins site vicinity show that additional beds of high quality red taconite outcrop at lower elevations (Hinshelwood 1994), and that further from the Cummins site, taconite outcrops at a range of elevations (Hinshelwood 1993). This suggests that taconite would have been available both inland and on the surface near the active shore. Where Gunflint Formation outcrops were coincident with active shorelines there is no doubt that the collection of lithic raw material for processing would have been facilitated. However, following the decline of water levels in the Superior basin, this advantage appears to have been replaced by a larger number of accessible sources (Hinshelwood 1994).

Regionally, the linear trend of the Gunflint Formation outcrop is continued west into Quetico by outcrops of Knife Lake siltstone. Lithic reduction patterns in Quetico/Superior Complex are similar to those of the Lakehead Complex, but with Knife Lake Siltstone predominating (Nelson 1992). South into Minnesota, Knife Lake Siltstone and some taconite is present in glacial drift from the boundary waters south to the Reservoir Lakes area and into central Minnesota (Bakken 1997; Malik and Bakken 1999; Mulholland *et al.* 2000).

Ross's construction of an Interlakes Composite (1995) is an effective framework for regional analysis. Four complexes show a general orientation towards either Lake Minong (Lakehead, Reservoir Lakes) on the east or Lake Agassiz on the west (Quetico, Rainy River). Interconnection between them is seen in the distribution of lithic raw material sources. Reservoir Lake Complex material is sourced in glacial drift deposits of primarily Knife Lake Siltstone with some Gunflint Formation taconite. The Lakehead Complex is centred on Gunflint Formation outcrops, and the Quetico/Superior Complex is centred on Knife Lake quarries in the Boundary Waters area. Plano materials from the Rainy River/Lake of the Woods Complex are made from a dark rhyolitic chert, which outcrops on Lake of the Woods and is geologically related to Knife Lake siltstone. Combined, the post-glacial lakes and lithic raw material sources describe a network upon which the initial late Palaeo-Indian occupation may have developed.

Plano Points

A wide range of projectile points has been recovered from Lakehead Complex and associated sites (see Ross 1979, 1995; Julig 1994). Within the region, the sample of early points is diverse, while individual sites produce few points in total. This diversity may reflect intermittent occupation by a range of otherwise non-resident groups. Many of the points have been tentatively identified as Agate Basin, Angostura, Scottsbluff variants and Minoqua (MacNeish 1952; Fox 1975; Julig 1984; Ross 1979, 1995; Hinshelwood, 1986). Ross (1995), in a review of the late Palaeo-Indian artifacts of the region concludes that while many of the lanceolate points have been ascribed to Agate Basin, the typological association is not certain, and many of these points should probably remain unclassified. This seems to lend support to Wright's (1972) hypothesis of a transition from late Palaeo-Indian to Archaic material culture manifest principally in the perseverance of lanceolate biface and projectile point forms, especially if we accept that the less typologically secure points originated later in the cultural sequence. It is worth noting that large corner notched points have been associated with late Palaeo-Indian laneolate points in cremation burial contexts (Mason 1981; Buckmaster and Paquette 1995) and have been given approximate dates of 8,500 to 7,000 B.P. (Mason 1981). These dates are similar to the date of the Cummins cremation burial at 8,180 +/-390 B.P. (Dawson 1983). At the Sheguiandah site, some mixing of cultural layers has also given the impression of corner notched materials associated with earlier plano material. Early contextual dates from Sheguiandah range between 9,100 and 9,500 B.P. (Lee 1957; Julig *et al.* 1991).

Archaic Occupation

The archaic occupation of northwestern Ontario is represented by a series of broad triangular corner-notched points with convex bases and also by variable amounts of native copper, ground stone and debitage. Lithic projectile point typologies have not been applied to the points from northwestern Ontario in view of the small number of points and their geographic distribution. Review of the Archaic occupation is also made difficult by an uncertain bias to this part of the archaeological record. The early Archaic is thought to be under-represented in the archaeological record because the timing for the transition from late Palaeo-Indian to Archaic occurred when lake levels in the Superior basin were lower than they are at present. Therefore, many shoreline occupations are assumed to be submerged or under sediments deposited post-8,000 B.P. Interior sites, sites on promontories and in areas where isostatic rebound may have preserved accessibility are anticipated, but this has yet to become a specific research focus. There is also a degree of difficulty in discriminating between Archaic and Woodland period lithics in some instances. Bias in the Archaic period archaeological record is also likely from the tendency to oversample lithics and undersample ceramics in surface collection of small sites. An unknown amount of woodland period material is included in the regional collections from "Archaic" sites.

Nevertheless, collections of Archaic material have been made and excavations at several sites complement these collections. Among the most significant regional Archaic collections is the Anderson collection from South Fowl Lake on the international boundary. Here, organics preserved in the haft of a copper point were dated to 6,800 B.P. (Beukens *et al.* 1992). Mike McLeod first identified the Renshaw site, and Arthurs (1989) carried out excavations. Renshaw is notable for its geomorphological position on a high cobble terrace slightly inland from modern Lake Superior. Uniformly poor quality of lithic materials were recovered (in both material used and artifact form) and three radiocarbon dates were determined on copper preserved organics that cluster between 5,000 and 5,300 B.P. (Beukins *et al.* 1992). In the Kamanistikwia River valley there were several findspots of copper artifacts. One findspot was located beneath 12m of lacustrine sediment (Tanton 1931, cited in Phillips 1993). Dawson also reported an isolated copper artifact, which was recovered from a construction trench in the north end of Thunder Bay in the early 1960's (Dawson 1966). Both of these latter examples show the effect of the Nipissing transgression (Phillips 1993) on the early archaic archaeological record.

Distribution of "Lakehead Complex" Sites

This paper argues that the location of an archaeological site upon an abandoned shoreline of post-glacial Lake Minong is not sufficient to demonstrate that the human occupation occurred when the shoreline was active. Figure 8.1a shows the distribution of archaeological sites described by the original researchers as late Palaeo-Indian, Archaic or aceramic in relation to the main Minong shoreline. Also shown are the general patterns of drainage and the position of a series of flat-topped mesas south of the city. These mesas mark the southern limits of a Minong age embayment of Lake Superior, and are the northern limits to the region of complex topography in which McLeod's (2001) survey efforts have been focussed. By including Archaic and aceramic sites in the map, the site distribution appears to be more dispersed around the main Minong shoreline; some are above this elevation and some below. The strict interpretation of this distribution would be that sites below the shoreline elevation must be Archaic, while those above the shoreline elevation could be late Palaeo-Indian with the strongest likelihood being for those sites immediately atop the main Minong shoreline. The sites that are located away from the Minong shoreline include the Crane Cache (DcJj-14), a large collection of Stage 3 and 4 taconite bifaces (and associated HBL chert scrapers); DcJj-11, where 20% of debitage is the locally distinct Kakabeka chert; DcJi-4, a findspot which includes a copper knife and an early stage Gunflint silica biface; an isolated biface recovered from the flank of the Dog Lake Moraine at Hazelwood Lake; and a findspot of copper artifacts (found using metal detectors) in a Thunder Bay city park. On the south shore of the Minong embayment is a findspot of a large Scottsbluff point made from Knife Lake siltstone.

In Figure 8.1b, the data described for the first figure is repeated with the addition of the area where Gunflint Formation bedrock is the upper geological unit. In many parts of this

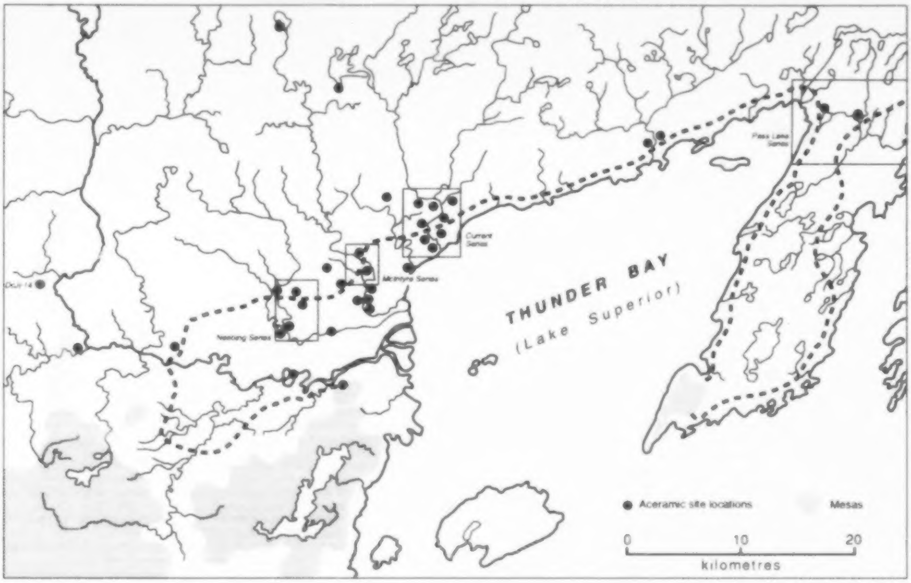


Figure 8.1a Distribution of Aceramic Sites in the Thunder Bay Area Relative to the Main Lake Minong Shoreline (dashed line). Archaeological Sites are Grouped into Series Based on Associated Watershed.

range, varying depths of glacial drift covers the bedrock and the bedrock is oriented to an essentially horizontal plane. However, steps in the bedrock are exposed in river channels and in marked changes in slope, especially at erosional shoreline features. In places, fragments of the bedrock have separated from the main body and are tilted, allowing them to outcrop locally away from topographic changes in slope. From these exposures, knappable taconite is often available. The aceramic sites show a much clearer association with the bedrock unit than with the main Minong shoreline. Southwest of the area shown in Figure 8.1, survey by McLeod has identified a similar pattern where a number of small interior sites are associated with Gunflint Formation outcrops and ephemeral post-glacial lakes (2001). Beyond the extent of the Gunflint Formation the landscape association of the sites may still be a valid method of relative dating.

For the purposes of this discussion, sites have been grouped according to associated river channels. Each "series" includes archaeological occupations associated with a stable water plane in the Superior basin (Minong or Nipissing), a river margin or both, and also includes occupations positioned inland from the Minong/Superior shoreline. Discussion of sites by series counters the assumptions inherent in reviewing sites in terms of elevation or associated post-glacial lake level, specifically the assumption of contemporeneity between formative period of a particular shoreline and timing of site occupancy.

Neebing Series: DCJI-1/DCJI-16 AND DcJi-3 (Figure 8.2)

The Neebing Series includes the Cummins site (DcJi-1: Dawson 1983; Julig 1984, 1994; Julig *et al.* 1986, 1990) and a range of small localities related to this large site complex, DcJi-16 (Hinshelwood 1994), Widar (DcJi-6) and Quackenbush (DcJi-3). Additional sites of this series are present, including a small lithic concentration identified to the east of the map area on an eroding bank of the Neebing River. This discussion will focus on the results of salvage excavations at DcJi-16 (Hinshelwood 1994). DcJi-16 is positioned on the west side of the Neebing River and covers the same range of elevations as Cummins (231 to 225 metres asl). The two sites can be considered as part of a single immense site, but have been assigned separate site numbers to facilitate their distinction in future analysis and reporting. Some differences in setting are noted, particularly with regard to soils. DcJi-16 is positioned on lacustrine and riverine landforms composed of relatively coarse-grained material. At DcJi-1 soils are finer sands with some dune development. Longshore currents from west to east along the post-Minong shore at this level are the probable source.

The study undertaken at DcJi-16 effectively sampled a topographic section between 230.5 and 223 metres asl (Figure 8.3). This section, covering a linear distance of just under 500 metres, corresponds to a similar section between the elevation of the main Cummins occupation at 230.5 metres asl and the lower reaches of Cummins (DcJi-15) at 217 metres asl (Julig 1994; Hinshelwood 1994). At DcJi-16, artifact recoveries did not follow a cultural sequence corresponding to elevation.

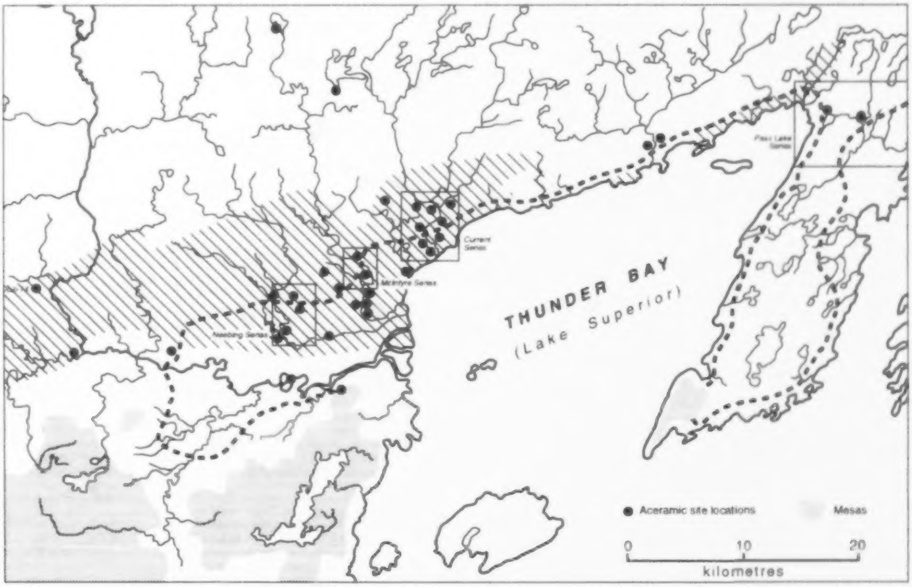


Figure 8.1b Distribution Shown in Figure 1a, also Showing the Range Where the Chert-Bearing Gunflint Formation is the Upper Geological Unit.

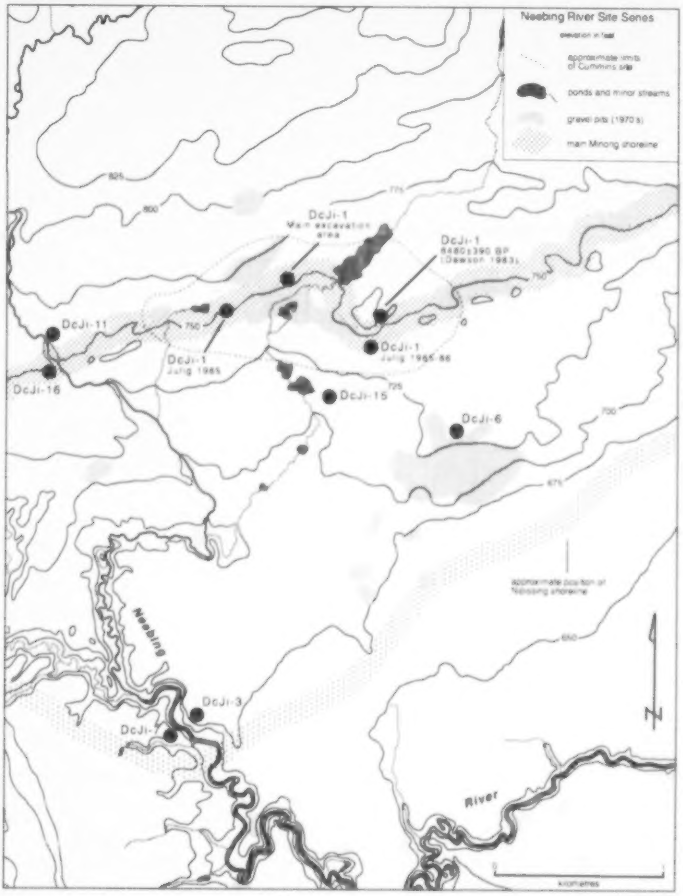
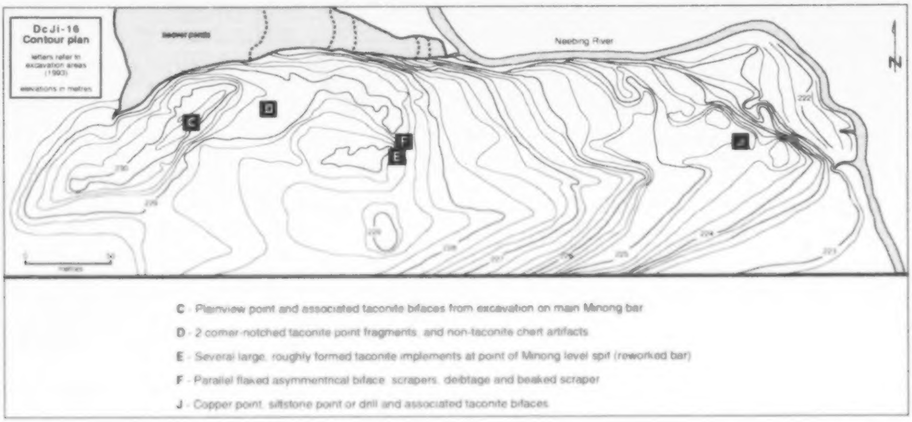

Neebing River Site Series
elevation in feet
approximate limits of Cummins site
ponds and minor streams
gravel pits (1970's)
main Minong shoreline
825
800
775
750
725
700
675
650
DcJi-1
Main excavation area
DcJi-1
6480±390 BP
(Dawson 1983)
DcJi-11
DcJi-16
DcJi-1
Julig 1985
DcJi-1
Julig 1985-86
DcJi-15
DcJi-6
approximate position of Nipissing shoreline
Neebing
DcJi-3
DcJi-7
River
N
0
1
kilometres

Figure 8.2 Neebing River Site Series. Included in this Distribution are the Cummins Site (DcJi-1).

Area C (Figure 8.3) is located at the crest of the main bar feature at the site, and the bar is at the same elevation as the main Minong beach at Cummins at 230.5 metres asl. The excavations at Area C recovered 5,970 artifacts from four clusters. Artifact patterning may have been cultural or the result of past bioturbation resulting from windthrown trees or other factors. Of particular interest is a Plainview projectile point, recovered in two parts from adjacent units in this excavation. The point has been identified on the basis of form, surface flaking and extensive basal and lateral grinding, following Justice (1987). Plainview points have also been recovered from Cummins (DcJi-1: Dawson 1983; Julig 1994) and Brohm (DdJe-1: MacNeish 1952). Plainview regularly occurs in stratigraphic levels immediately above Clovis-fluted materials on sites in the southwestern United States. In northern Ontario, Plainview may be taken to indicate late Palaeo-Indian occupation towards the earliest period available for human entry, circa 9,500 B.P.



C - Plainview point and associated taconite bifaces from excavation on main Minong bar

D - 2 corner-notched taconite point fragments, and non-taconite chert artifacts

E - Several large, roughly formed taconite implements at point of Minong level spit (reworked bar)

F - Parallel flaked asymmentrical biface, scrapers, debitage and beaked scraper

J - Copper point, siltstone point or drill and associated taconite bifaces

Figure 8.3 DcJi-16 Contour Plan

Excavation at Area D was completed to bedrock, a depth of less than 30 centimetres. Surface elevation was 229 metres asl, and the excavation area lay on the lake side of the Minong bar at the point where it begins to show signs of curving to the west, reworked by Neebing River flow. A total of 1,103 artifacts were recovered from the excavations, which places the density of recoveries from this block well below that of other excavated areas. Diagnostic artifacts recovered from this excavation include two fragmentary corner-notched projectile points, two unifaces, one of Hudson Bay Lowland chert (HBL), the other of Kakabeka chert, and a worked flake of an unknown siltstone. Regional use of HBL chert is believed to commence in the Archaic (Julig 1984). Kakabeka chert is a distinctive form of Gunflint Formation chert and is present in minor amounts at defined late Palaeo-Indian occupations (see Hamilton 2000 for a recent summary). Julig (1994) recovered an Angostura type point from Cummins manufactured of Kakabeka chert.

Areas E and F, at elevation 228.75 metres asl, represent occupations on a spit formed when the main Minong bar was reworked by flow from the Neebing River. The artifacts associated with these excavations are particularly interesting if we accept that occupation was on the active lake margin. A total of 18,966 artifacts were recovered from Block E and a further 18,908 artifacts were recovered from Block F.

Block E yielded a number of large, heavy chopping and scraping tools which are presumed to have been manufactured for use in the rough processing of large game. Two large scrapers, which may have been used hafted, are similar to rough scrapers present in the Biloski Site (DcJh-9) collection (Hinshelwood and Webber 1987). Another large artifact is a tabular piece of bedrock taconite, which has been variously worked in a unifacial and bifacial fashion along one edge. In Area F, a refined asymmetrical taconite biface exhibiting oblique parallel flaking was recovered. Oblique parallel flaking is considered typical of the late Palaeo-Indian period. Also recovered were a range of unifacially retouched scrapers, including a beaked scraper or perforator. It may also have been a suitable locale for caribou procurement and processing during calving. Calving takes place in the spring on exposed beaches, which afford good visibility of predators and relief from the various flying insects (Bergerud 1985). Caribou hunting has been proposed as the rationale for the location of the Brohm site (MacNeish 1952; Mason 1981), and for the isolated find at DdJe-3 (Hinshelwood 1990).

Area J is located at an elevation of 224.75 metres asl. To the northeast of the excavation, the land surface slopes steeply into a more recently active Neebing River channel, and the area can be considered to have been a riverbank occupation regardless of the position of the active lake margin at the time. A total of 7,907 artifacts were recovered, including 27 bifaces, 12 worked flakes and 8 cores. A copper projectile point – another example of Archaic period occupation – was also recovered. The copper point exhibits bending at the tip which is thought to be the result of pressure from a tree root applied over time. In addition, an untyped projectile point, possibly of dolomite or siltstone and showing collateral flaking and a diamond cross-section, was found.

The presence of copper at Area J defies simple explanation. On the geomorphological data alone, occupation could have occurred at any time between the emergence of this part of the landscape (post 9,400 B.P.) and the present. If we assume that the Cummins cremation burial took place along an active shoreline, then the circa 8,500 B.P. date for this event at 230m asl (Dawson 1983) reduces the range of potential dates for Area J by over 1,000 years. However, it is not possible to reduce the date range further, as the site is above the elevation of the Nipissing transgression (circa 5,000 B.P.). The possibility that it represents an inland foray is as great as the chance that it reflects a littoral occupation of either a recessional Minong or transgressive Nipissing Lake.

Figure 8.2 shows both the approximate line of the main Minong, marked today by a line of archaeological sites and gravel pits, and Nipissing transgressive levels. Detailed mapping of the complex geomorphology of the Cummins site area, (Phillips 1988; Julig 1994) demonstrates that most of the sand ridges in the map area show some sign of prehistoric occupation. DcJi-15 south of the Cummins site area is an unremarkable and heavily disturbed site adjacent to a shale and gravel pit. However, the shale pit provides access to at least three distinct and thick beds of high quality red taconite. The dip of the bedrock suggests that they outcrop further south, perhaps at the elevation of the Widar site (DcJi-6). The material present in these beds is remarkable when compared to the miserable material found in the bedrock knob, the popularly held source of the Cummins raw material. Further south and adjacent to the Nipissing transgression levels, are the Quackenbush (DcJi-3) and Stetsko (DcJi-7) sites. These sites are known only from limited surface collections in the mid-1970's and have produced no diagnostic materials. It is uncertain how dense the artifact deposits are at these sites, but it seems unlikely that they match Cummins.

Cummins has produced a small amount of clearly identifiable Archaic material. Dawson (1983) reports the recovery of a taconite side-notched point in 1963 and Julig reports the recovery of a side-notched point base (1984). Julig also reports two radiocarbon dates on charcoal from the main Minong beach occupation of Cummins. Charcoal from a pit feature was dated to 2380±125 B.P. (S-2460), and a pooled sample of charcoal from a hearth was dated to 2300±125 (S-2426). The latter feature was associated with HBL chert debitage, which Julig considers representative of the archaic period rather than late Palaeo-Indian. In his dissertation, however, Julig rejects the material dated from these features as intrusive

(1994). Julig provides dates for two of the Cummins areas, which are also relatively late. The lower Minong occupation dates to before 8,000 BP while the bog edge occupation dates to between 7,500 and 8,000 B.P. (Julig *et al.* 1990).

McIntyre Series: DcJh-9/DcJh-38 (Figure 8.4)

The breach in the main Minong shoreline at the McIntyre River is flanked by three aceramic sites (Figure 8.4). Salvage excavations at two of these sites, DcJh-9 (Hinshelwood and Webber 1987) and DcJh-38 (Hinshelwood 1987) recovered a large amount of debitage and at DcJh-9, a significant collection of bifaces broken and discarded at various stages in manufacture. The debitage densities, while high, do not match the densities observed at Cummins or DcJi-16.

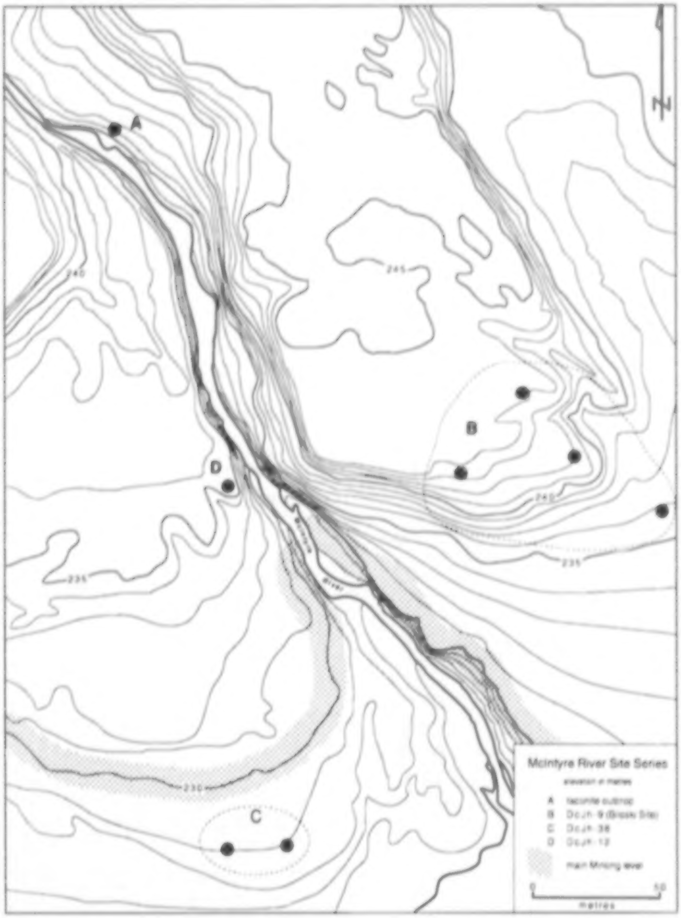

N
A
240
245
B
D
240
River
235
235
230
C
McIntyre River Site Series
elevation in metres
A taconite outcrop
B DcJh-9 (Biloski Site)
C DcJh-38
D DcJh-12
main Minong level
0
50
metres

Figure 8.4 McIntyre River Site Series. Included in this Distribution is the Biloski Site (DcJh-9).

The third site, DcJh-12 is known only from a small surface collection. Figure 8.4 shows the position of the sites relative to local topography. As with the Cummins site area, longshore currents have sorted soils leaving the west bank in coarse sand and gravel and the east bank in fine water sorted sands. In the vicinity of these sites, the main Minong shoreline is located at about 230 metres asl. Archaeological occupation of the landscape occurs at three different levels, mostly above the level of the main Minong shoreline. Occupations at DcJh-9 lie between 242 and 244 metres asl, with a lower occupation at 235 metres asl, the same elevation as DcJh-12 west of the river. The elevation of DcJh-38 is 229 metres asl. Therefore, the occupation of the Biloski site is either an occupation of an early active shoreline of Minong, or it demonstrates a preference for the higher, better drained sand bluff away from the water to an inferior location closer to the water's edge. Figure 8.4 also shows a potential quarry location for taconite where the bedrock is exposed in the stream channel.

Diagnostic artifacts recovered from these sites are limited. At Biloski several projectile points or point fragments were recovered, including an Agate basin-like point and the base of an Agate Basin-like "Manitoba" point (Hinshelwood and Webber 1987; Hinshelwood 1986). A third point has been tentatively described as similar to the Minoqua variant of Scottsbluff (Hinshelwood and Webber 1987; see Ross 1979). Ross' original identification of Minoqua materials in the Lakehead Complex area relied on well-formed points, which were obviously executed to the knapper's desired end. The artifact from Biloski is not well formed and has a large flaw in the raw material, which runs the length of one edge of the blade. Other artifacts from the site include a denticulate, two drill fragments and a large number of bifaces in various stages of production. The denticulate may be considered a diagnostic Palaeo-Indian implement type. At DcJh-38 the sole diagnostic artifact is a very small base fragment from a point made of Hixton silicified sandstone. Julig *et al.* (1989) has demonstrated that Hixton is one of the principal exotic cherts present in collections from the Thunder Bay area. The base, although small, appears to be from a lanceolate point. There are no corner-notched points in the McIntyre River Series.

Additional sites of the McIntyre series, not mapped for Figure 8.4, consist of four small debitage scatters adjacent to the river. These sites, DcJh-24, DcJh-13, DcJh-14 and DcJh-15, all cluster around the approximate elevation of the Nipissing transgressive shoreline. The original survey crews identified these sites as Archaic on the basis of elevation and the presence of taconite debitage. One site, DcJh-14, also produced several small lumps of copper (Newton and Englebert 1977).

There are no radiocarbon dates for archaeological sites of the McIntyre River Series. Excavations at DcJh-38 demonstrated the site to be shallow, with the majority of the undisturbed deposits lying at the interface of the mineral and organic soil. Deeper features could be readily seen against the fine-grained, well-drained sands as root disturbance resulting from windthrow of larger trees.

Current River Series: DcJh-39, DcJh-40, DcJh-41 and the Current River Mouth Sites(Figure 8.5)

In the Thunder Bay area, the largest number of known archaeological sites is found adjacent to the Current River. Figure 8.5 shows 16 sites from this series. The Simmonds site (DcJh-4: Dawson 1972; Fox 1975; Halvorsen 1992) has produced a taconite Plainview point and a

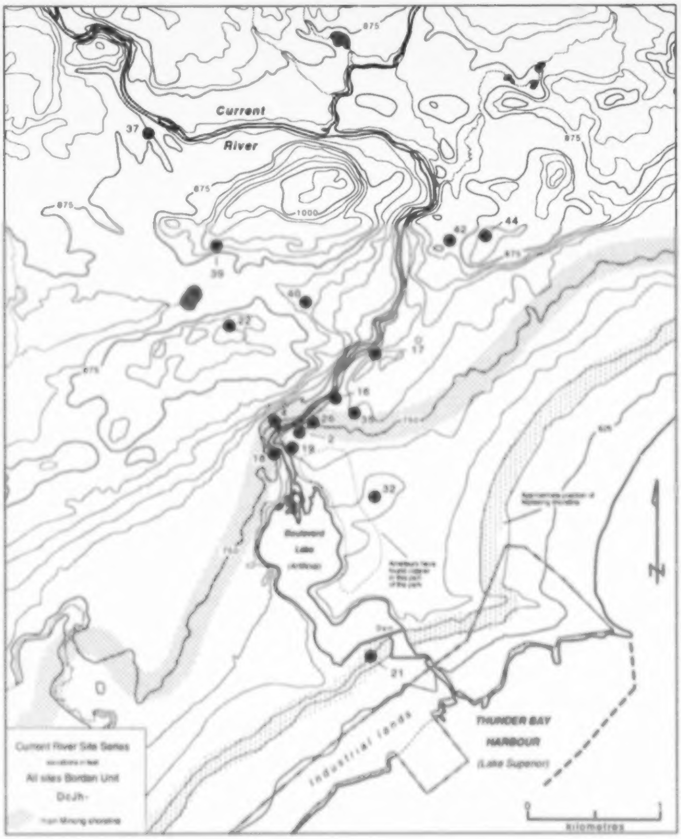

Current
River
875
1000
37
44
42
39
40
22
17
18
26
35
2
19
16
750
32
625
Boulevard
Lake
(Artificial)
Dam
21
industrial lands
THUNDER BAY
HARBOUR
(Lake Superior)
Current River Site Series
elevations in feet
All sites Borden Unit
DcJh-
main Minong shoreline
0
1
kilometres

Figure 8.5 Current River Site Series. Sites are Clustered Around a Series of Baymouth Features where the Current River Emptied into Lake Minong.

refined oblique parallel flaked biface, while the remainder of the sites have produced only taconite biface or debitage. While no native copper has been recovered under controlled conditions, copper artifacts have been recovered to the east of the Boulevard Lake reservoir.

Boulevard Lake is an artificial lake, expanded through dredging and dam construction, as part of a depression-era employment initiative. However, the north and south limits of Boulevard correspond to the main Minong and Nipissing transgressive shorelines respectively. The depositional history of the mouth of the Current River at the north end of Boulevard Lake is complex, and has been thoroughly reviewed by Phillips (1988). A number of small aceramic sites are found atop the baymouth features formed where the Current River entered Lake Minong about 9,500 B.P.

It is within the Current River series that the greatest number of interior sites is also known. Among these are the Chairs quarry site (DcJh-40) and the Happy Days site (DcJh-39), a small concentration of debitage exposed on a dirt bike path (Hinshelwood 1993). Test exca-

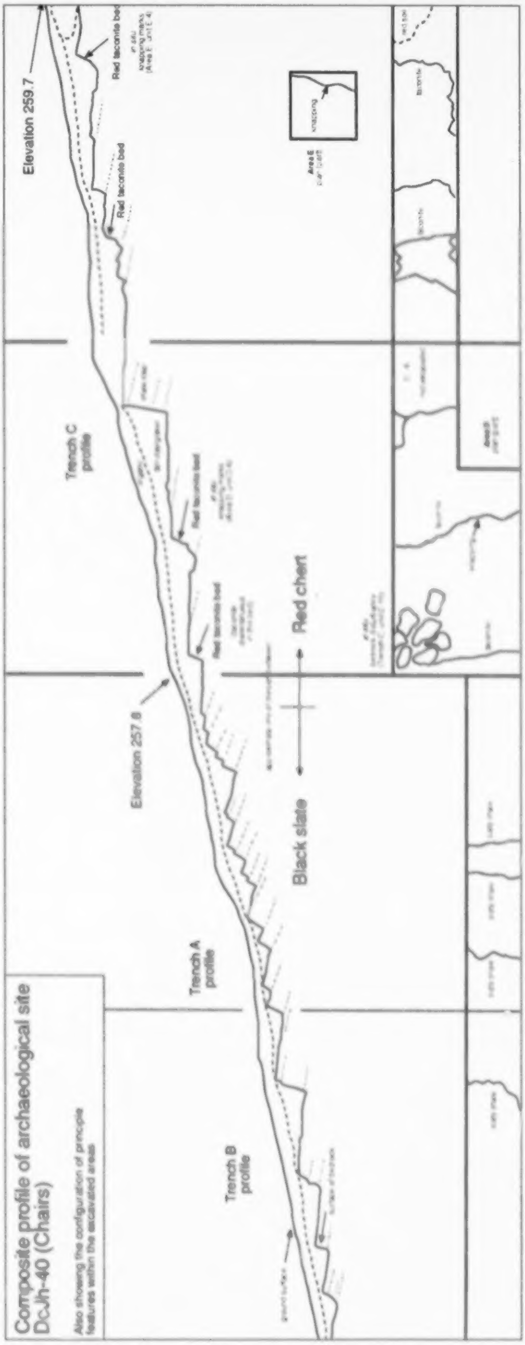
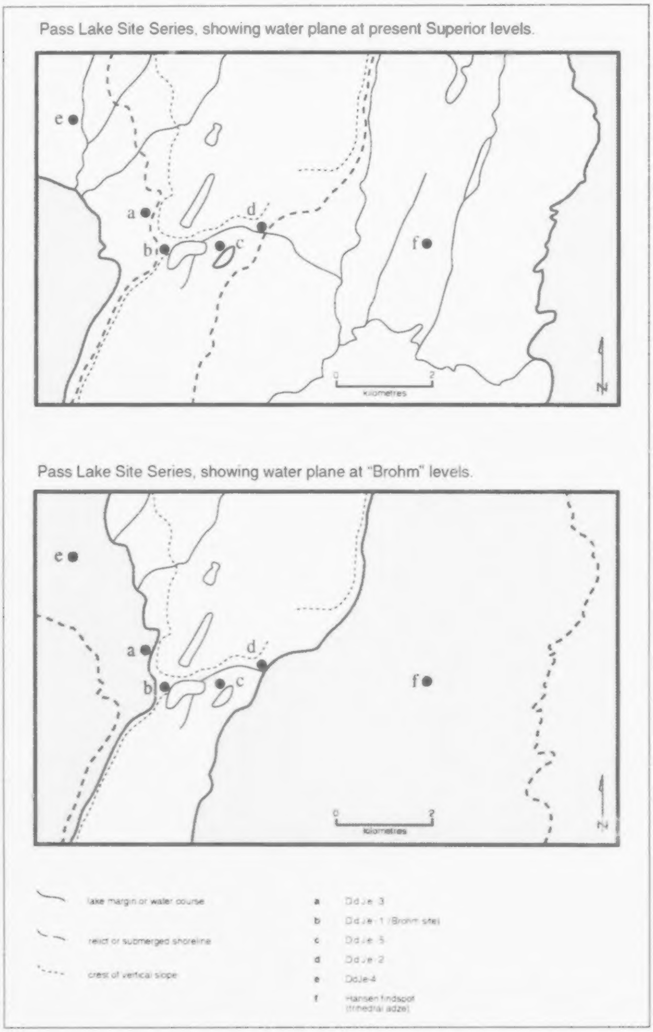

Composite profile of archaeological site DcJh-40 (Chairs)
Also showing the configuration of principle features within the excavated areas
Trench B profile
Trench A profile
Trench C profile
Elevation 257.8
Elevation 259.7
Black slate
Red chert
Red taconite bed
Red taconite bed
Red taconite bed
Red taconite bed
Area E
knapping

Figure 8.6 Composite profile of the Chairs site (DcJh-40), showing four distinct taconite chert beds available for Late Palaeo-Indian procurement



Pass Lake Site Series, showing water plane at present Superior levels.

Pass Lake Site Series, showing water plane at "Brohm" levels.

e
a
d
b
c
f
0
2
kilometres
N
lake margin or water course
relict or submerged shoreline
crest of vertical slope
a DdJe-3
b DdJe-1 (Brohm site)
c DdJe-5
d DdJe-2
e DdJe-4
f Hansen findspot (trihedral adze)

Figure 8.7 Pass Lake Site Series. Included in this distribution is the Brohm site (DcJe-1).

vations were carried out at the Cascade II site by Arthurs (1986), and at the Naomi site (DcJh-42) by Nick Adams. DcJh-42 produced a heavily resharpened Hixton silicified sandstone lanceolate point base.

These interior sites provide us with very good information concerning the relationship between human occupation, relict shorelines and lithic raw materials. The distribution of sites inland from both the Current River and the Minong shore are oriented towards the lithic resource. Some poor quality raw material may be available in the near vertical rock faces behind Simmonds, and from the river channel below McDaid; however good quality material is abundant in bedrock outcrops in the nearby uplands, as at the quarry site, DcJh-40. Figure 8.6 is a composite profile of DcJh-40 prepared from field data collected during the salvage excavation of a portion of the site. The bedrock in this exposure dips at an angle of 25° to 30° with the result that a 4-metre vertical change in slope has provided access to the equivalent of a 10-metre vertical face. Within the exposure are four separate beds of good quality red taconite. The individual beds range in thickness between about 15 and 30 centimetres. In two locations in the excavations in situ, knapping marks were identified, and lower in the profile, a form of black slate is available. While this material exhibits conchoidal fracture, it does not appear to have been used in lithic production at the site (Hinshelwood 1993).

One additional landscape feature relating to DcJh-39 and DcJh-40 should be noted. These sites are positioned on opposite sides of a topographic low area, which is separated from the Current River by a bedrock ridge on one side and a large gravel bar, dating to the early Minong or perhaps Beaver Bay levels, on the other. Currently, the low area is occupied by a small pond, which drains into the Current River below DcJh-40. It is tempting to suggest that the sites are oriented towards an interior water body that was formed through the presence of an ice dam between the bedrock ridge and gravel bar, similar to those noted by McLeod south of the city (2001). Future investigations of this area may reveal shoreline features relating to an ephemeral lake within this area.

Pass Lake Series (Figure 8.7)

In the foregoing discussion, archaeological sites positioned on Minong level shoreline features could not be separated from sites in areas directly associated with local outcrops of Gunflint Formation bedrock. Limited survey and chance recovery of archaeological material above and below the elevation of the main Minong shoreline has identified sites that show stronger association with bedrock than the Minong shore and other sites or artifacts that suggest occupation long after the Minong beaches were abandoned. The sequence of occupations represented in the Pass Lake series provides perspective on the occupation of Minong and post-Minong beaches where the local bedrock is not a factor in occupation.

The Pass Lake series consists of six sites, four of which are grouped around a gap in the bedrock mesa, which runs the length of the Sibley Peninsula. This gap had been an open water passage during the highest Minong levels, but was gradually sealed off as a result of sedimentation and lower water levels after 9,400 B.P. (Phillips 1988). The best known late Palaeo-Indian site in the Pass Lake series is the Brohm site (DdJe-1). The elevation of the main beach at Brohm is positioned at 253 metres asl (Phillips 1988). This beach is on the same plane as the main Cummins beach, but is currently higher as a result of isostatic uplift (Phillips 1988). MacNeish (1952), who excavated at the site in 1950, recognized the association of the early artifact styles represented in the assemblage and the abandoned shoreline feature. Subsequent visits to the site by Lee (1971), Quimby and Griffin (Quimby 1960; Griffin 1961) and Wright (1963), confirmed this association for the highest portion of the site. As part of his investigation of the site in 1957, Tom Lee recorded a series of wave-formed beaches below the main beach level. Lee reports on two corner-notched points from Brohm, and gives the approximate location where one of them was found. Lee also reported that debitage at the site could be found as far downslope as the 224 metre asl level (Lee 1971; Hinshelwood 1990).

A detailed survey of the Brohm site was carried out in 1987. The primary purpose of the project was to identify the extent and condition of cultural materials remaining at the site (Hinshelwood 1990). Fieldwork at Brohm recorded the spatial distribution of cultural material and recent disturbance patterns, and also relocated one of MacNeish's excavations. Probable locations for the corner-notched points reported in Lee's field notes were also identified. It was noted that one relatively large portion of the site remains undisturbed and appears to have been outside of the ploughed area of the Brohm farm. During the fieldwork, local citizens provided information on four additional sites in the immediate vicinity of Brohm.

Figure 8.7 shows the distribution of the six sites of the Pass Lake series. Two of these sites, Brohm and Andersen (DdJe-2), are positioned at either end of the pass. At the time of the earliest occupation of Brohm, these sites would have been backed by a vertical rock face and would have faced into the open water of a channel separating the main part of Sibley peninsula from the mainland. The deepest part of this channel is preserved in Pass Lake, the small lake immediately south of the Brohm site that was cored by McAndrews in 1975 (McAndrews 1976, 1986).

Artifacts recovered from the Pass Lake Series sites show a greater variety of lithic raw materials than at other Lakehead Complex sites. This is consistent with the position of Brohm away from the main taconite outcrops with no other local alternative save siltstone and dolomites of the Sibley Group, and is seen in other areas, such as southern Ontario (Roberts, 1984). Julig's analysis of the Brohm collections identified a greater number of useable edges per implement than at the Gunflint Formation associated sites (1994). MacNeish's report on Brohm lists one "Plainview" and several other lanceolate points; however, two corner-notched points have also been recovered. One of these was sketched in 1957 by T.E. Lee and was accompanied by a report, which stated that it was found by Brohm "about 700 feet southwest" of MacNeish's excavation area. Southwest is the downslope direction at the site, and the approximate elevation of the findspot has been estimated at or below 244 metres asl, considerably lower than the MacNeish excavations at 253m asl (Hinshelwood 1990). Other finds in the Pass Lake area include a small collection of debitage and bifaces manufactured from locally available dolomite (DdJe-2), an asymmetrical stemmed taconite biface (DdJe-3), and an irregularly shaped taconite biface from a gravel pit (DdJe-5) east of Brohm, at an elevation of 243 metres asl. The asymmetrical biface is similar to a fragmentary biface recovered from Brohm in 1987. The biface recovered at DdJe-5 is similar to bifaces recovered at Biloski and other sites in the Lakehead Complex core area. A small side-notched taconite point was recovered from a field north of Brohm, at an approximate elevation of 213 metres asl (DdJe-4). A trihedral adze was also reported by Fox in the late 1970's (Fox 1977b) and, although he did not register the findspot as a site, it is at the approximate location presented in Figure 8.7, at an elevation of approximately 213 metres asl. Trihedral adzes are considered to be typical of the toolkit of other late Palaeo-Indian complexes, such as the Caribou Lake

Complex (Buchner 1981; Pilon and Dalla Bona, this volume). However, Fox (1977b) viewed the adzes as originating outside of the late Palaeo-Indian material culture, which is also a position supported by Julig (1994), among others.

In Figure 8.7, the relative position of the Pass Lake Series sites to present and Minong levels is shown. Here, the association of the presumably late Palaeo-Indian sites with dry land at Minong levels is demonstrated. The Archaic notched point and trihedral adze are submerged. The corner-notched points of the Brohm collection would also be under water at the Minong level.

Conclusion

The late Palaeo-Indian Lakehead Complex was originally defined on the basis of three specific criteria: plano materials, association with Minong beaches, and predominant use of Gunflint Formation taconite (Fox 1975; 1977a). Subsequently, application of the term has become increasingly relaxed (Dawson 1983) and primarily focussed on the geomorphological position of the sites. In some instances the presence of taconite debitage alone has been presented as the basis for determining a late Palaeo-Indian affiliation. The association of sites with Minong-age beaches remains an important consideration in regional Palaeo-Indian studies. Relative dating has provided archaeologists with an initial date of occupation in the Complex at 9,600 to 9,400 B.P. (Julig *et al.* 1990). However, evidence for the occupation of the active shoreline of Lake Minong exists only at Cummins (Julig *et al.* 1990) and possibly at Catherine (DcJh-11), where water-worn artifacts were also reported (Fox 1975). The association of sites with abandoned shoreline features of Lake Minong has been helpful in directing additional inventory survey work both at the Lakehead and to the south (McLeod 2001; Phillips and Hill, this volume).

Evidence indicates that the shoreline-associated sites were also occupied after 9,400 B.P. when lake levels were dropping and the active lake margin was becoming increasingly distant from the sites. This reoccupation produces several interesting challenges for the regional researcher. Site specific studies will be required to isolate single component sites and single episode activity areas. These will be necessary if detailed artifact studies, which compensate for the unknown degree of artifact mixing on shoreline sites, is to be conducted satisfactorily. Another regional consideration is the presence of high quality taconite found at elevations below the main Minong level. While no corresponding large debitage scatters at these elevations are presently known, does this mean that the resource was not utilized? It is possible that no use was made of this resource, but equally possible that the people preferred to transport the material back to well-drained locales associated with the abandoned beach ridges. In the absence of a clear break in the archaeological record following the late Palaeo-Indian occupation, it will be difficult to establish a plausible terminal date for late Palaeo-Indian occupation and also the relationship that this group holds to the subsequent Archaic population.

From this review it appears that the primary regional determinant of site occupation is the presence of high quality Gunflint Formation taconite rather than the active shoreline. Considering the late Palaeo-Indian population, it seems likely that they entered the region from the south and west, following the general distribution of glacially transported and then late bedrock sources of lithic raw material. This would ensure that their capacity to manufacture stone tools was sufficient to meet the demands of the emerging post-glacial landscape. The presence of an active shoreline coincident with the outcrops would have facilitated procurement, travel and quite possibly, seasonal exploitation of caribou and other subsistence resources. Visibility of the shoreline outcrops of taconite would have decreased after about 9,400 B.P., as water levels in the Superior basin declined and the active shoreline moved rapidly away from the large sites. However, the presence of higher, well-drained sand ridges may have been attractive as longshore travel routes or hunting areas after 9,400 B.P., especially following forest fire. Even if the active lake margin was preferred for occupation, fortuitous discovery of the lithic source areas would have resulted in the periodic use of these sites and newly-discovered quarry sources, in retoling. The rate at which Minong shoreline sites became interior sites is variable across the Lakehead Complex area. At Brohm, declining water levels may have only gradually reduced the value of the locale as an attractive area for seasonal caribou hunting (Hinshelwood 1990) while at Biloski (Hinshelwood and Webber 1987), the abandoned site would have been fronted by extensive alder flats with low carrying capacity for game. Ultimately however, the use of Gunflint Formation taconite declined as late Archaic and Woodland period lithic assemblages shifted to the expedient use of cobble cherts from glacial drift and moraine deposits.

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9.

Geoarchaeological Context for Late Paleo-Indian Archaeology in the North-Central Upper Peninsula of Michigan, USA

John B. Anderton, Robert S. Regis and James R. Paquette

Abstract

In the last 15 years, several Late Paleo-Indian archaeological sites have been found in the central and northern portion of Marquette County in the Upper Peninsula of Michigan, USA. Analysis of the Late Quaternary chronology and associated landforms, as well as paleoenvironmental reconstructions, reveals Late Paleo-Indian people could have entered the area as Greatlakean ice retreated into the Lake Superior Basin, beginning as early as 11,000 to 10,500 B.P. Plano people, as represented by the Agate Basin (ca. 10,500 to 10,000 B.P.) and Hell Gap (10,000 to 9,500 B.P.) projectile point traditions, were present in the area during the Gribben (interstadial) phase and appear to have been living within 10 to 15 km of an active glacial front during the Marquette (stadial) Advance (ca. 10,000 B.P. maximum). They were also present during the retreat of Marquette ice from the south shore of Lake Superior. People from the Great Lakes Cody (Scottsbluff/Eden 9,400 to 9,000 B.P.) projectile tradition occupied the area immediately following the retreat of Marquette ice as lake levels dropped from the Main Minong phase to the Houghton Low.

Résumé

Au cours des 15 dernière années, plusieurs sites archéologiques du Paléoindien supérieur ont été identifiés dans les portions centre et nord du Comté de Marquette dans la péninsule supérieure de l'État du Michigan (États-Unis). L'analyse de la chronologie du Quaternaire supérieur et des modelés associés, ainsi que les reconstructions paléoenvironnementales, révèlent que le peuple du Paléoindien supérieur aurait pu arriver dans la région lors du retrait de la glace des Grand lacs dans le basin du lac Supérieur entre 11 000 à 10 500 A.A. Le peuple Plano, représenté par les pointes de projectiles de type Agate Basin (vers 10 500 à 10 000 A.A.) et Hell Gap (10 000 à 9 500 A.A.), était présent dans la région lors de la phase Gribben (inter-

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stadiaire) et semble avoir vécu entre 10 à 15 km d'un front glacial actif lors de l'avancée glaciaire de Marquette (stadiaire), vers 10 A.A. au maximum. Il était aussi présent lors du retrait de la glace de Marquette du rivage sud du Lac Supérieur. Le peuple représenté par les projectiles de type Cody des Grand Lacs (Scottsbluff/Eden 9 400 à 9 000 A.A.) occupa la région immédiatement après le retrait de la glace de Marquette lorsque le niveau du lac passa de la phase Main Minong à Houghton Low.

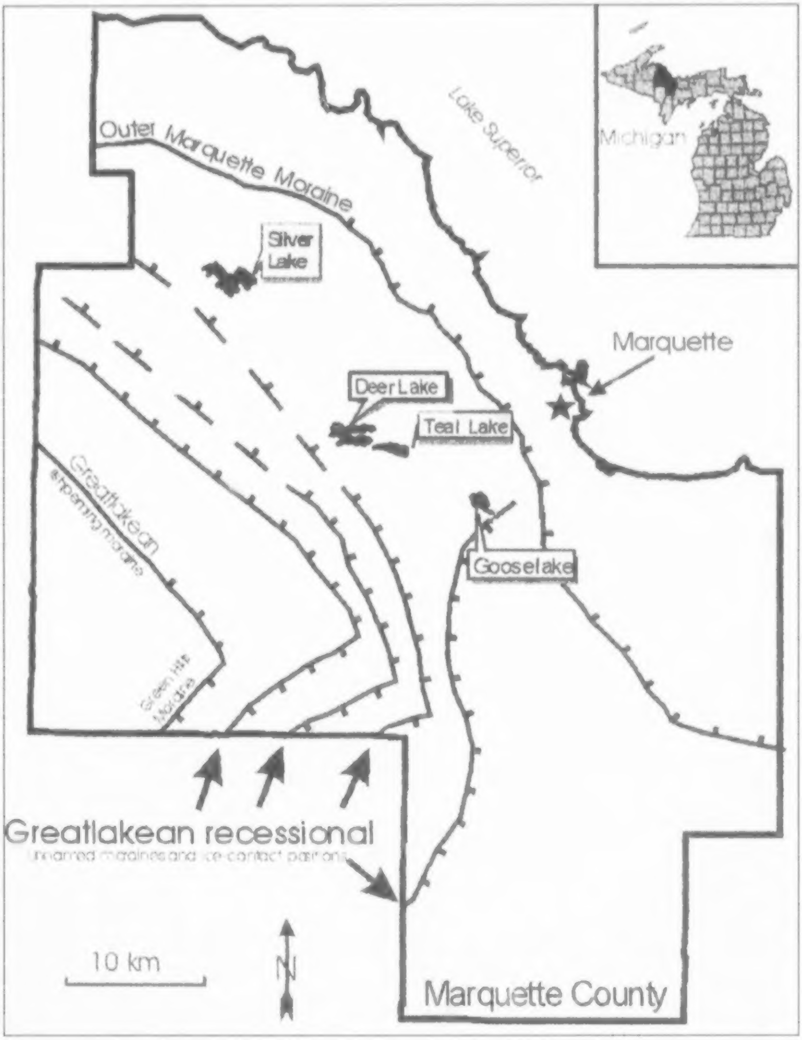
Outer Marquette Moraine
Lake Superior
Michigan
Silver Lake
Deer Lake
Teal Lake
Marquette
Gooselake
Greatlakean
Ishpeming moraine
Green Hill Moraine
Greatlakean recessional
unnamed moraines and ice-contact positions
10 km
N
Marquette County

Figure 9.1 Major Glacial Positions and Archaeological Localities in Marquette County, Upper Peninsula of Michigan, USA

Introduction

Recently, several Late Paleo-Indian sites (ca. 10,500 to 9,000 B.P.) have been found within the north central Upper Peninsula of Michigan (Buckmaster 1989a, 1989b, 1997; Buckmaster and Paquette 1988, 1996; Clark 1989) in Marquette County (Figure 9.1). These sites represent the earliest documented human occupation of the area. They bear a strong resemblance to nearby Late Paleo-Indian complexes of the Interlake Composite in northwestern Ontario (Ross 1995), as well as the flambeau and Minocqua Phases in northeastern Wisconsin (Salzer 1974), and the Reservoir Lakes Complex of northern Minnesota (Harrison *et al.* 1995). Basic descriptions and artifact analysis have been performed to date, and researchers are beginning to understand the archaeology of these early sites in Marquette County (Buckmaster 1997). However, the geoarchaeological context of the sites remains very poorly understood as no systematic examination of site settings, stratigraphy, or paleoenvironmental reconstructions has been carried out. Consequently, the connection between the Paleo-Indian archaeological presence and Late Quaternary glacial and lacustrine events, especially pertaining to the Late Pleistocene/Early Holocene Marquette Advance, is ambiguous. The purpose of this paper is three-fold: 1) to provide a preliminary examination of site settings; 2) to explore possible connections between the sites and known glacial and lacustrine events during the Late Quaternary; and 3) to posit preliminary paleoenvironmental reconstructions. Finally, the findings will be used to provide a geoarchaeological context that is needed to properly interpret these recent discoveries. All dates mentioned in the text are in radiocarbon years.

The Study Area

The study area is located in the Upper Peninsula of Michigan adjacent to the south shore of Lake Superior, within the northern half of Marquette County (see Figure 9.1). The city of Marquette is located on the east side of the county adjacent to Lake Superior, while the towns of Negaunee and Ishpeming are located to the west, 20–25 kilometers (10–15 miles) inland and away from the lake. The Carp, Dead, and Yellow Dog Rivers drain into Lake Superior; and the Peshekee, Michigamme, and Escanaba Rivers are tributaries to the Lake Michigan basin. Elevations range from about 183 meters (600 feet) at Lake Superior to over 600 meters (1975 feet) in the Huron Mountains. The climate of the region is cool, humid continental with long, snowy winters and short, cool summers. The area lies in an ecological transition zone between the deciduous forests of the southern Great Lakes region and the coniferous boreal forests to the north of Lake Superior. Soils generally consist of Spodosols developed on well-drained uplands, rock outcrop complexes in rocky highlands, and Histosols in poorly-drained wetland areas. Geologically, the study area lies at the boundary between the Canadian Shield, a large mass of Precambrian crystalline bedrock that extends south from Canada into the western Upper Peninsula; and the Michigan Basin, a structural basin consisting of Paleozoic and younger sedimentary strata that dips gently to the southeast under the eastern Upper Peninsula and Lower Peninsula of Michigan. The Marquette Syncline, an east-west trending belt of folded and faulted Precambrian metamorphic quartzites, volcanics, iron for-

Table 9.1 Late Quaternary Geochronology of Ice Lobes in the Northern Great Lakes and Associated Late Paleo-Indian Projectile Point Traditions.

		Ice lobes					
Years B.P. C^{14}	**Advance**	**West-central Lake Superior**	**Central Lake Superior**		**East-central Lake Superior**	**Northeast Wisconsin**	**Late Palaeo-Indian Projectile Point Tradition**
9,000					Grand Marais III		Great Lakes Cody (9,400–9.000)
			Lake Superior Lobe				
					Grand Marais II Grand Marais I		Hell Gap (10,000–9,500)
10,000	Marquette	Six Mile	Inner Marquette Outer Marquette				
			Lobes				Agate Basin (10,500–10,000)
			Green Bay	Michigamme			
11,000		Watton					
	Greatlakean	McDonald	Green Hills	Ishpeming	?	Late Athelstane	
12,000			Late Sagola	Republic			
13,000	Woodfordian (Port Huron)	Winegar	Sagola	Saint Johns		Early Athelstane	

mations, slates, and schists, runs prominently across the southern half of the study area. Precambrian intrusive granites and gneisses border the syncline on the north and south, while Paleozoic sedimentary rocks form a contact on the east side of the study area. A mantle of glacial till, outwash, and lacustrine deposits discontinuously covers the bedrock.

Late Quaternary Geochronology and Associated Landforms

The Late Quaternary geochronology of the northern Great Lakes is quite complex (Table 9.1). For the purposes of this paper, we will begin with the Woodfordian deglaciation of the region at about 13,000 B.P. At that time, the central Upper Peninsula of Michigan was covered by the Laurentide ice sheet, which was moving from the northeast across the Lake Superior basin. Retreat toward the northeast gradually uncovered the central Upper Peninsula between the period beginning at 13,000 to 12,500 B.P. and ending at about 9,500 B.P. when ice retreated past the current position of the north shore of Lake Superior for the last time (Hughes and Merry 1978). The oldest known glacial deposits in the study area are found within the Saint Johns and Sagola moraines in the extreme western portion of Marquette County (Peterson 1985, 1986). Peterson (1985, 1986) attributes these sediments to deposition by the Michigamme and Green Bay lobes of the Woodfordian Substage (approximately 13,000 to 12,500 B.P.), which entered the area from the northeast and east, respectively. Based on morphological evidence, he suggests lobe movements were synchronous (Peterson 1985, 1986). Although mainly working farther to the west, Peterson's mapping–carried over into the western border of Marquette County. It drew attention to the existence of one significant moraine segment northeast of the Saint Johns' moraine and two segments east of the Sagola moraine in the western part of the study area. Peterson (1985, 1986) suggests that these moraines are slightly younger than the deposits of the maximum advances. Furthermore, the younger of the two moraines east of the Sagola moraine may be time-equivalent to the MacDonald moraine, which was deposited by the Ontonagon lobe in the western Upper Peninsula of Michigan about 11,000 B.P. In contrast, Clayton (1984) correlates the southeastern segment of the Sagola moraine with the late Athelstane moraine in eastern Wisconsin. The late Athelstane moraine was deposited during the Greatlakean Advance (11,850 B.P.). Regis (1997), who studied the glacial geomorphology and ice-dynamics of central Marquette and northern Dickinson counties, supports Clayton's interpretation. Regis (1997) also named the equivalent of the late Athelstane moraine in Marquette County. Thus, the younger of the two moraines east of the Sagola moraine was likely deposited during the Greatlakean advance. At this time, the Michigamme lobe formed the Ishpeming moraine and ice-contact scarp. It is generally believed that ice from this advance reached its maximum extent about 11,850 B.P. and began its retreat about 11,500 B.P. Thus, the far western portion of the study area was ice-free sometime after the beginning of the Greatlakean retreat, indicating a maximum date for human occupancy sometime after 11,500 B.P. (Figure 9.1).

Retreat from the terminal positions left several recessional moraines and ice-contact features (see Figure 9.1) as recognized by Regis (1997). Stuart *et al.* (1954) first noticed several outwash terraces south of Negaunee and Ishpeming at elevations between 470 and 388 meters (1550 and 1280 feet). The most prominent terraces are at 442-m (1460 feet), 424-m

(1400 feet) and 394-m (1300 feet) elevation. Successively lower surfaces were thought to have formed by erosion of the higher outwash plains and subsequent deposition at a lower base level (Stuart *et al.* 1954). Regis (1997) indicates that the surface slope of each terrace is toward the west, suggesting that sediment sources must have been from the east. Black (1966, 1969) also recognized the outwash plains (terraces) south of the town of Ishpeming, which he used to trace the Valders (now named Greatlakean) ice margin from northeast Wisconsin to the Upper Peninsula of Michigan. Later, Regis (1997) identified eight distinct outwash terraces in this area, each with successively lower elevations from extreme western Marquette County toward Lake Superior. Each terrace has at its eastern edge an abrupt escarpment or moraine, which Regis (1997) interprets as ice-contact margins that represent still-stand positions or slight re-advances of ice lobes as they retreated into the Lake Superior basin (see Figure 9.1).

Eventually, retreat of all the Greatlakean lobes left the entire (modern) Upper Peninsula free of ice for at least several hundred years, which was enough time for drainage of Lake Agassiz waters into the Lake Superior basin to occur (Drexler *et al.* 1983). Growth of the Gribben forest near Marquette, Michigan (Hughes and Merry 1978) and likely many others across the Upper Peninsula, occurred during this period. Most recently, this period between the Greatlakean retreat and the Marquette Advance has been designated as the Gribben phase (Karrow *et al.* 2000).

The Marquette Advance is represented by the two youngest (easternmost) of the moraine-outwash plain pairings in Marquette County (Figure 9.1). These landforms represent a significant re-advance of the Superior Lobe, which was first documented by Hughes and Merry (1978) and based upon the discovery of an *in situ* forest of spruce and tamarack buried by outwash at the Gribben tailings basin in central Marquette County. This last advance, however, only extended 10–15 km inland from the present-day shoreline of Lake Superior throughout most of the study area. Wood samples taken from trees in the Gribben buried forest were originally ^{14}C dated at approximately 9,850 B.P. Based on this evidence, Hughes and Merry (1978) identified a final Late Pleistocene/Early Holocene pulse of ice that was thought to have moved west and south out of the Lake Superior basin. More recently, Pregitzer *et al.* (1999) completed a detailed study of the paleoecology of the Gribben forest bed. Additionally, Lowell *et al.* (1999) recently provided a more refined estimate of the age of the forest bed at 10,025 ± 100 ^{14}C B.P. based on the analysis of nine wood samples.

The Marquette moraines (outer and inner end moraines) are correlated to the Grand Marais I & II moraines, which are located about 100 km to the east of the study areas near Munising, Michigan (Drexler 1981; Drexler *et al.* 1983). Drexler (1981) and Drexler *et al.* (1983) identified a third moraine that was younger than the inner Marquette moraine (Grand Marais III), located near the shore of Lake Superior in the Munising area. However, an equivalent to this younger Marquette Advance moraine does not seem to extend into northern Marquette County (Regis 1997). As Marquette ice eventually retreated from the south shore of the Upper Peninsula, drainage occurred along its margin. Although difficult to trace in the rocky terrain of northern Marquette County, Hughes (1971; 1989) identified several channels to the southeast of the study area that formed during discharge events from the proglacial Duluth and post-Duluth Lakes in the western Lake Superior basin. Eastward drainage of these lakes was allowed as the Marquette ice front receded northward from the face of the Huron Mountains, exposing eastern outlets for the lakes.

The final portion of the Quaternary history that is relevant to this study involves Lake Minong, which occupied the Lake Superior Basin at about 9,500 B.P., following the retreat of Greatlakean ice from the basin. Eventually, a major drop in lake levels occurred as the partially till blocked outlet at the Sault became eroded (Farrand and Drexler 1985), which may have been affected by erosional effects of intermittent overflows from Lake Agassiz (Teller and Thorleifson 1983; Teller 1985; Phillips and Fralick 1994). Lake levels continued dropping until the bedrock sill at the Sault was reached at about 8,000 B.P., creating the Houghton Low, the lowest Holocene lake level in the Superior Basin. In response to this tremendous base level change, rivers began down-cutting, forming steep-sided valleys, which are still in evidence today. Eventually, as outlets isostatically rebounded, lake levels rose during the Nipissing transgression, reaching their highest position at approximately 4,700 B.P. and leaving a prominent shoreline at about 195 m (640 feet). The Nipissing shoreline is located up to several kilometers inland from the modern shoreline of Lake Superior in Marquette County.

The Archaeological Record

The following overview is organized based on archaeological localities where Paleo-Indian material has been found and professionally studied in the Marquette County area (Figure 9.1 and Table 9.2). The overview is meant to provide a basic description of each site locale, the extent of survey and excavations that have been done, the important components that are present, and any interpretations of site type and usage, all of which are based on previous investigations. For a more detailed account of each site, please see the respective original publications. This section closes with a discussion of proposed site ages.

Deer Lake Locale

The Deer Lake locale is a modern, 906-acre reservoir located immediately north of the town of Ishpeming, which was created by a local iron mining company to provide hydroelectric power, beginning in the early half of the 20th century (Figures 9.1 and 9.2). Prior to the building of the reservoir, the area consisted of the original Deer Lake, a natural 100-acre kettle lake, and a series of small ponds or lakes, connected by the upper reaches of the Carp River. These natural features were impounded until the bed of the Deer Lake Reservoir was exposed in the mid-1980s when it was temporarily drawn down for environmental reasons. In 1986 and 1987, during surface survey of the exposed shoreline areas surrounding the original Deer Lake, two local avocational archaeologists John Gorto and James R. Paquette recorded 22 archaeological sites (Paquette n.d.).

Following these initial discoveries, Buckmaster and Paquette (1988) presented the results of a surface collection and partial excavation of a presumed Late Paleo-Indian crematory feature at the Gorto site (20MQ39). An intensive survey of the eroded sand and gravel-rich surface areas that bordered the east-northeast corner of Deer Lake located several discrete clusters of cultural material. Two of these surface concentrations were comprised entirely of intact and fragmented lanceolate Plano-type projectile points. The smaller of the two Plano artifact clusters was surface collected and mapped, while two adjacent 2 by 2 m test excava-

Table 9.2 Late Paleo-Indian/Early Archaic Archaeological Sites, Marquette County, Upper Peninsula of Michigan, USA.

Site Name	State Number	Cultural Horizon/Style	Reference
Negaunee	20MQ32	Plano/Cody (?)	Buckmaster (1985)
Paquette	20MQ34	Plano/(?)	Buckmaster (1989)
Water's Findspot	20MQ35	Plano/Agate Basin	Paquette (1986c)
Gorto	20MQ39	Plano/Cody (Scottsbluff/Eden)	Buckmaster and Paquette (1988)
Silver Lake Dam	20MQ40	Plano/Cody (Scottsbluff)	Buckmaster and Paquette (1996)
Silver Lake North Bay	20MQ41	Late Palaeo-Indian and Early Archaic/(?)	Buckmaster and Paquette (1996)
Deer Lake #4	20MQ44	Plano/(?)	Clark (1989)
Deer Lake #7	20MQ47	Plano/(?)	Clark (1989)
Deer Lake #8	20MQ48	Plano/(?)	Clark (1989)
Deer Lake #9	20MQ49	Plano/(?)	Clark (1989)
Deer Lake #12	20MQ52	Plano/(?)	Clark (1989)
Deer Lake #14	20MQ54	Plano/(?)	Clark (1989))
Deer Lake #15	20MQ55	Plano/(?)	Clark (1989)
Mount Mesnard	20MQ64	Late Palaeo-Indian(?)	Buckmaster (1997)
Silver Lake #3	20MQ68	Plano/Hell Gap	Buckmaster and Paquette (1996)
Silver Lake #4	20MQ69	Plano/Cody	Buckmaster and Paquette (1996)
Silver Lake #7	20 MQ72	Plano/(?)	Buckmaster and Paquette (1996)

tion units were set up over the nearby larger concentration. The resultant test excavation uncovered a large lithic assemblage comprised entirely of Cody Complex Scottsbluff/Eden projectile points and Early Archaic side-notched projectile points.

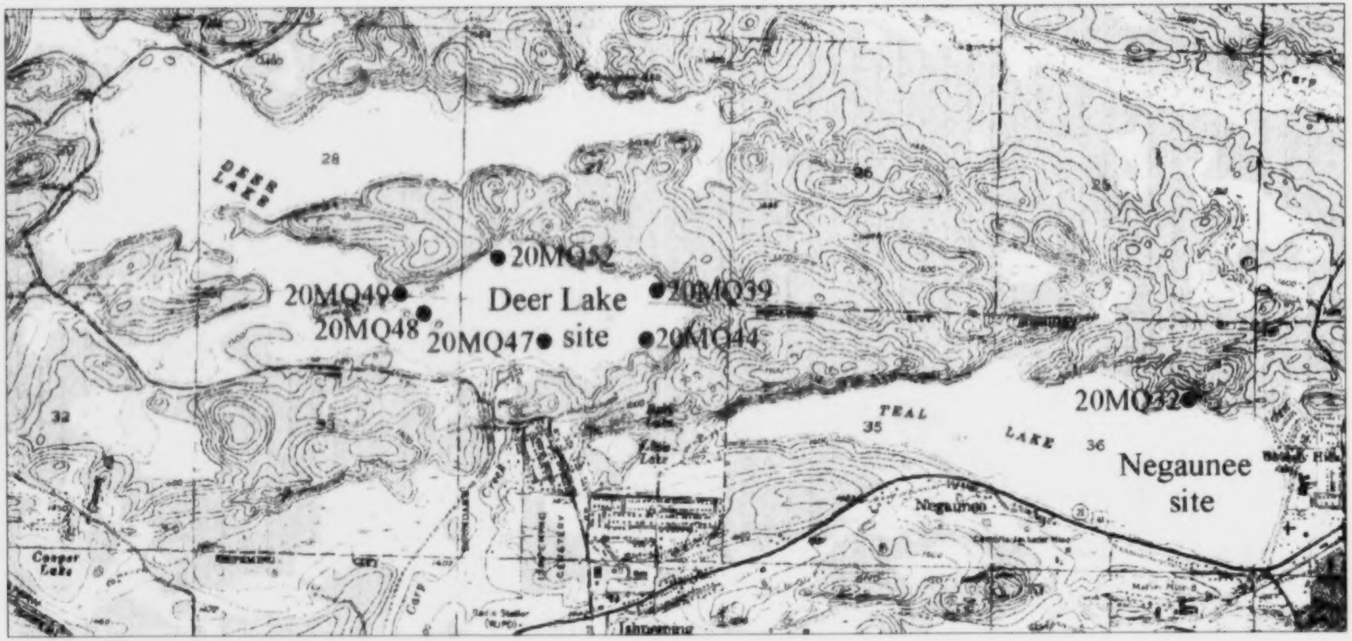
DEER LAKE
28
20MQ52
20MQ49
20MQ48
Deer Lake site
20MQ47
20MQ39
20MQ44
26
25
TEAL LAKE
35
36
20MQ32
Negaunee site
32
Cooper Lake
Negaunee
Ishpeming

Figure 9.2 Deer Lake Locale and Negaunee Site Location. Map excerpt is from USGS 1:24,000 Negaunee SW (1958, Photo-Revised 1975) and Negaunee, Mich (1953, Photo-Revised 1975) Quadrangles.

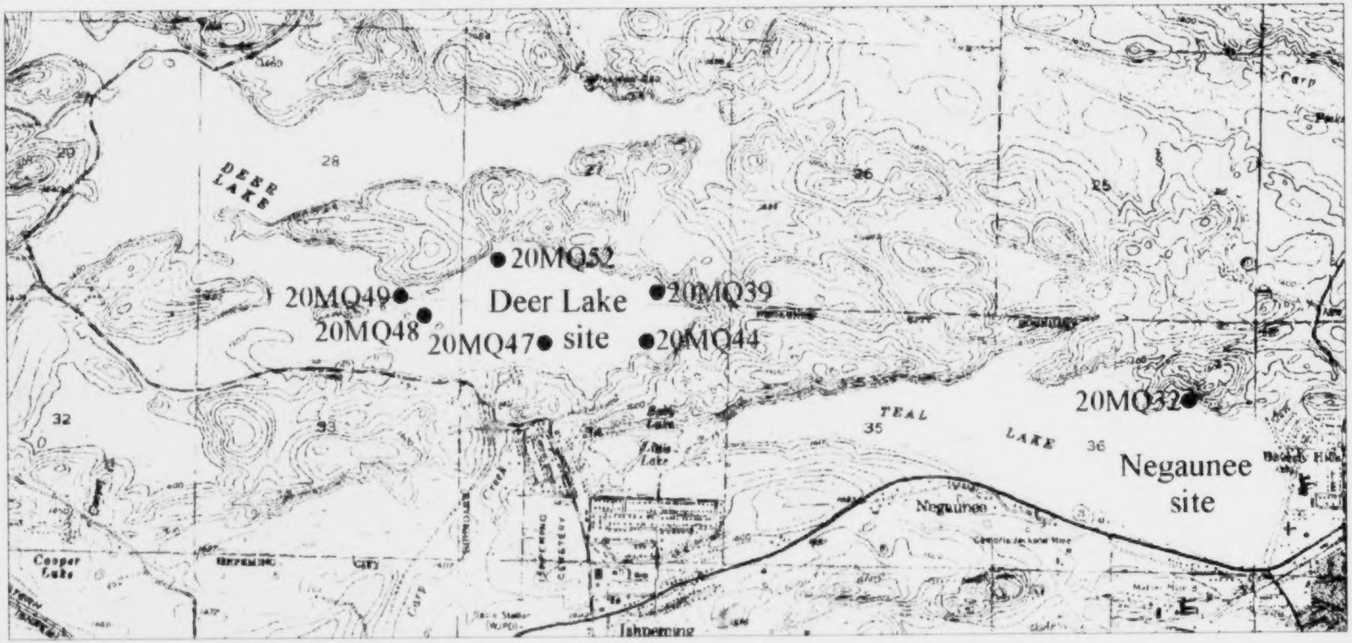
DEER LAKE
28
29
27
26
25
20MQ52
20MQ49
20MQ48
20MQ47
Deer Lake
site
20MQ39
20MQ44
32
33
TEAL
35
LAKE
36
20MQ32
Negaunee
site
Negaunee
Cooper Lake
Carp
Ishpeming

Figure 9.2 Deer Lake Locale and Negaunee Site Location. Map excerpt is from USGS 1:24,000 Negaunee SW (1958, Photo-Revised 1975) and Negaunee, Mich (1953, Photo-Revised 1975) Quadrangles.

Rising water in the reservoir abruptly terminated the excavations at the Gorto site and prevented a full investigation of both Plano projectile point clusters. However, despite this, a total of fourteen complete or nearly complete Plano/Great Lakes Cody projectile points and four Early Archaic side-notched projectile points were recovered at the site (Buckmaster and Paquette 1988: 106). In addition, at least fifteen and possibly as many as eighteen other Late Paleo-Indian/Early Archaic points were represented by various fragments. Except for five of the points, all of the Gorto site projectile points were manufactured from Hixton silicified sandstone. Buckmaster and Paquette (1988) suggest that this large deposit of mostly heat-fractured projectile points represents a cache of materials that was ritually burned as part of a human cremation. This supposition was based upon their comparison of the Gorto site projectile points with similar heat-altered artifacts and comparable data that was retrieved from other suspected early cremation sites in the Great Lakes region (Dawson 1983; Deller and Ellis 1981; Mason and Irwin 1960; Ritzenthaler 1972).

Following Buckmaster and Paquette (1988), Clark (1989) also summarized archaeological data gathered from the Gorto site and from 21 other sites found on Deer Lake. Clark (1989) describes two additional diagnostic Plano artifacts, including an unburned Hixton Scottsbluff projectile point found in three fragments immediately south of the presumed crematory feature at the Gorto site, and a burned Hixton biface (Scottsbluff) fragment found at the Deer Lake #12 site (20MQ52).

The combined assemblage from the various sites on Deer Lake consisted largely of lithic flake debris, non-diagnostic tools, and tool fragments. However, Clark (1989: 89) contends that based upon the presence of artifacts manufactured from Hixton silicified sandstone and

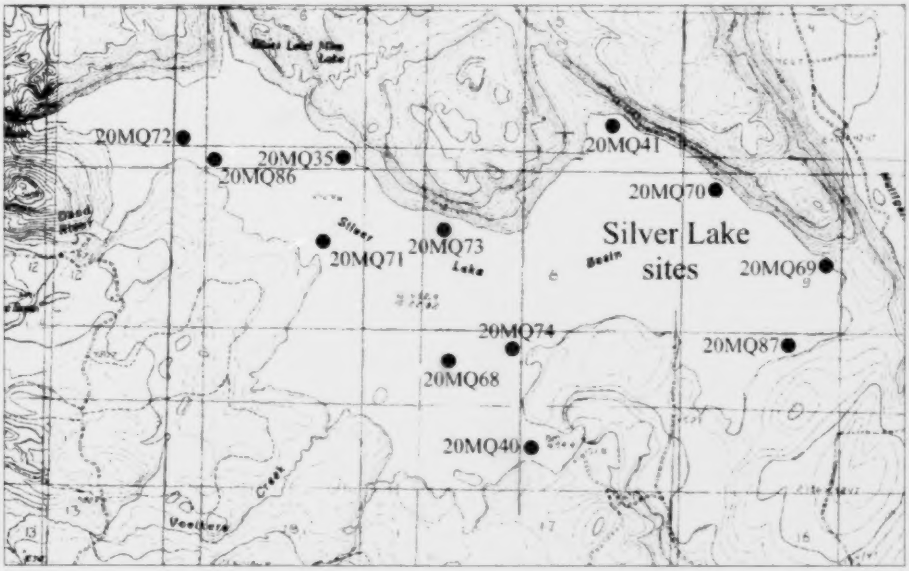

Figure 9.3 Silver Lake Locale. Map excerpt is from USGS 1:24,000 Silver Lake Basin, Mich. Quadrangle (1954, Photo-Revised 1975).

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Following Buckmaster and Paquette (1988), Clark (1989) also summarized archaeological data gathered from the Gorto site and from 21 other sites found on Deer Lake. Clark (1989) describes two additional diagnostic Plano artifacts, including an unburned Hixton Scottsbluff projectile point found in three fragments immediately south of the presumed crematory feature at the Gorto site, and a burned Hixton biface (Scottsbluff) fragment found at the Deer Lake #12 site (20MQ52).

The combined assemblage from the various sites on Deer Lake consisted largely of lithic flake debris, non-diagnostic tools, and tool fragments. However, Clark (1989: 89) contends that based upon the presence of artifacts manufactured from Hixton silicified sandstone and

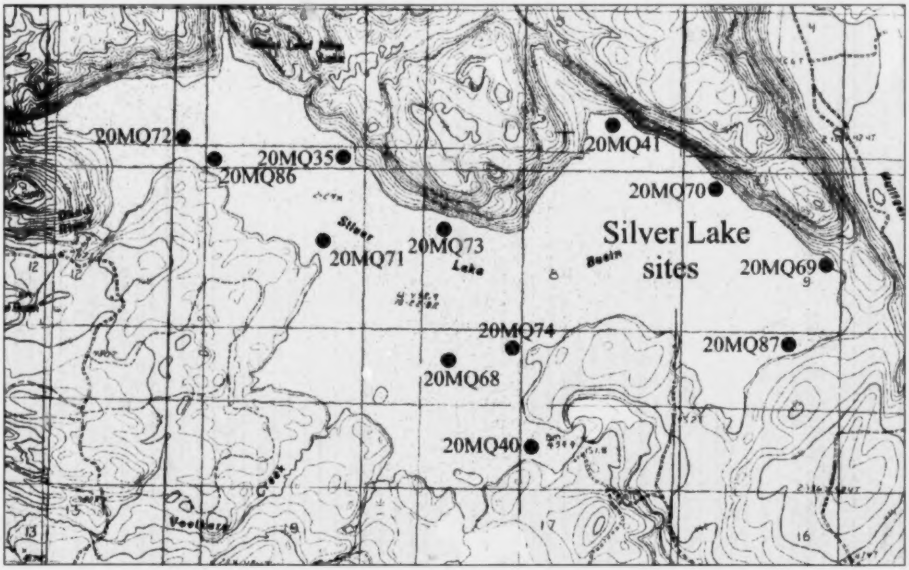


Figure 9.3 Silver Lake Locale. Map excerpt is from USGS 1:24,000 Silver Lake Basin, Mich. Quadrangle (1954, Photo-Revised 1975).

local quartzite, and Plano projectile points and other early tool types, several of the 22 Deer Lake sites represent Late Paleo-Indian activity loci. He suggests that these occupations were probably associated with the flambeau or Minocqua phase as described by Salzer (1974) for a number of small sites in Wisconsin (Clark 1989). Clark (1989: 106–107) recognizes the repeated association of Hixton silicified sandstone with Plano diagnostics. Thus, he argues that the near universal use of Hixton for Scottsbluff points in areas of Wisconsin and Upper Michigan indicates that knappers from the flambeau/Minocqua phase were effectively dependant on this specific raw material for the formal aspects of their tool kit. Clark (1989) further concludes that the presence of this highly preferred raw material in the lithic inventory could be used as a valid means to establish a minimum number of possible Late Paleo-Indian sites on Deer Lake. Consequently, Clark (1989) tentatively identifies eight of the Deer Lake sites as being Plano, including 20MQ39, 20MQ44, 20MQ47, 20MQ48, 20MQ49, 20MQ52, 20MQ54 and 20MQ55. However, Clark (1989) adds that the small quantities of Hixton in the overall lithic industry suggests that several of the other sites, particularly those in which quartzite predominate as the raw material, may also be Late Paleo-Indian in origin.

Silver Lake Locale

The Silver Lake Locale is also a reservoir created by a local iron mining company for hydroelectric power (Figures 9.1 and 9.3). The impoundment basin, dating from the early 1900s, inundated the natural Silver Lake basin along the headwaters of the Dead River in the far northern reaches of Marquette County. The first documented discovery of a Late Paleo-Indian projectile point in the Upper Peninsula of Michigan was made on Silver Lake Basin (Paquette 1986c). An Agate Basin projectile point made from Hixton silicified sandstone was reported found at the Waters' Findspot site (20MQ35) by a local resident. The discovery of this classic early Plano artifact on the north shore of the Silver Lake Basin, and the desire to document other possible Paleo-Indian occupations in the Marquette County area, led Paquette and Gorto to undertake an intensive surface survey of the basin in 1987 and 1988. This resulted in the discovery of ten prehistoric sites. At that time, drought conditions throughout the region had a significant impact on water level in the Basin. As a result, the reservoir was drawn down to a surface elevation that was close to the pre-dam level of the inundated natural Silver Lake. This aided the survey efforts as the original shoreline areas that once surrounded the lake were exposed.

Following the initial field efforts, Buckmaster and Paquette (1996) reported on the results of the surface survey and detailed their analysis of the artifacts that were recovered during the project. The sites were found on the eroded, non-vegetated surface of the exposed reservoir bed on the north shore, near the inlet and the outlet (Dead River) of the basin, and on the Dead River itself. Concentrations of debris, fire-cracked rock, hammerstones and numerous other tools including various bifaces, unifaces, scrapers, cores, and gravers made from Hixton silicified sandstone, quartzite, quartz, chert, slate, and other local materials were discovered. In addition, copper artifacts, including socketed and conical points, tanged knives, awls, and an adze were recovered from one of the sites, suggesting a Late Archaic presence on Silver Lake. However, clearly diagnostic Late Paleo-Indian artifacts were discovered on three of the ten archaeological sites located during the Silver Lake survey.

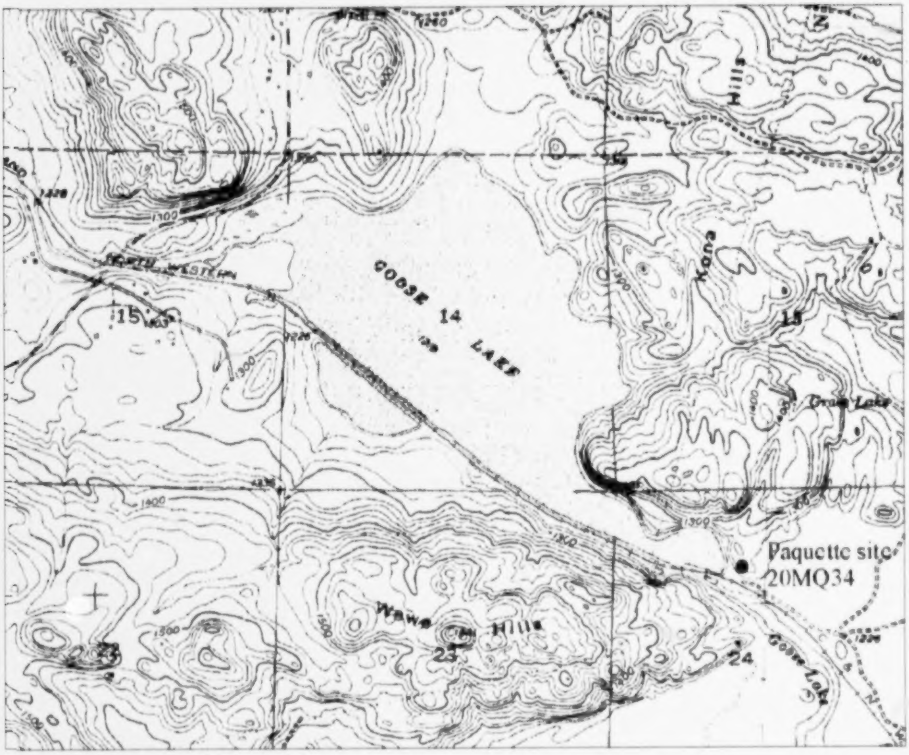
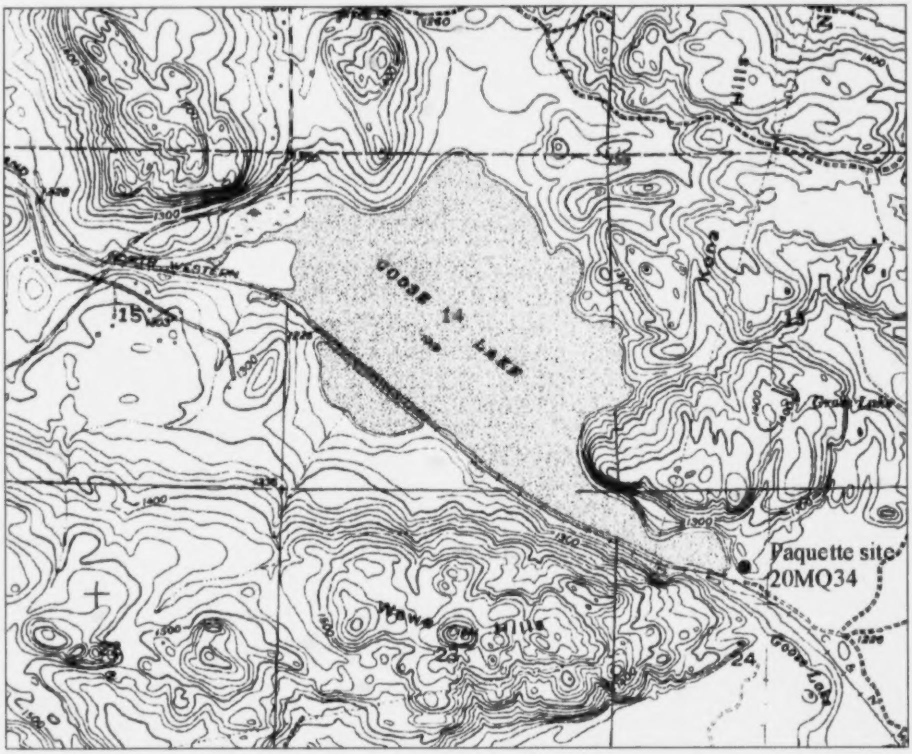


Figure 9.4 Paquette Site Location. Map excerpt is from USGS 1:24,000 Palmer, Mich. Quadrangle (1952, Photo-Revised 1975).

The base and shoulder portion of a broken Scottsbluff point made from Hixton silicified sandstone was found at the Silver Lake Dam site (20MQ40). Additional cultural material recovered from the site included quartz and chert scrapers, quartz edge-retouched knives, quartz, quartzite and chert cores and debitage. The site was located on the south shore of the basin just to the west of the Dead River dam on what was originally the bank of the lake's outlet.

A Hell Gap projectile point of Hixton silicified sandstone was found at Silver Lake #3 site (20MQ68). This complete lanceolate Plano point was found on the east shore of an island in the reservoir that was once an elevated ridge near the outlet of the original lake. Dobbs and Breakey (1994) also reported finding a lanceolate projectile point fragment on this site during their 1993 Phase I archaeological survey of the basin. The point was described as being a large patterned biface fragment made from an unidentified igneous material. The point fragment, which may also be Plano in origin, was found on the beach in the same area where the Hell Gap point was collected earlier.

The base portion of a Great Lakes Cody-eared projectile point made from Hixton silicified sandstone was found during a follow-up visit to the Silver Lake #4 site (20MQ69) in 1994.



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This site is located in the far northeast corner of the lake. Besides this highly distinctive Plano artifact type, Silver Lake #4 also produced two additional Hixton projectile point fragments during the initial survey. The first is the extreme distal end of a point that was found in close proximity to the Cody-eared point base. The other Hixton point fragment consists of the base and partial blade portion of a large Early Archaic side-notched projectile point. Other artifacts found at the site include a complete chert corner-notched point, a siltstone trihedral adze, quartzite, quartz, chert, slate, and felsite bifaces and unifaces, fire-cracked rock, and assorted lithic debitage.

Two additional bifaces made from Hixton silicified sandstone were recovered from two other sites during the survey. The first is the distal/blade portion of a Hixton Plano point. It was found at Silver Lake #7 site (20 MQ72), which is located upstream on the Dead River inlet at the far west end of the basin. The other Hixton biface is a well made backed knife that was found on the north shore of the lake at the Silver Lake North Bay site (20MQ41). The presence of these formal tools made from Hixton silicified sandstone strongly suggests the possibility that a Late Paleo-Indian/Early Archaic component exists at these two sites as well.

Paquette Site

The Paquette site (20MQ34) is an apparent Late Paleo-Indian occupation located on the east end of Goose Lake (Figures 9.1 and 9.4), a medium sized inland lake situated approximately 3.5 km north of the Gribben buried forest (Hughes and Merry 1978). The site was discovered in 1985 by Paquette (1986a), and was further investigated in 1987 by Northern Michigan University (Buckmaster 1989). Shovel testing, surface collecting, and limited test excavations suggest that the site boundaries extend at least 500 m along the east shore of the lake and the nearby lake outlet.

Historic settlement, a railroad right-of-way, and the more recent use of the area as a rustic boat landing and campsite disturb much of the site. However, several areas of the site remain undisturbed, including a small portion of the site located on a low terrace remnant overlooking the outlet. Atop this terrace, three 1-m^2 excavation units revealed intact cultural deposits ranging in depth from just under the leaf litter to a depth of 40 cm below the surface (Buckmaster 1989). Two cultural horizons were separated by 5–20 cm of sterile sand. While it is not clear if these levels are culturally distinct, they can be separated on the basis of lithic type percentages. The upper occupation zone is predominantly local Ajibik quartzite, while the lower zone consists of a wide variety of lithic materials. Buckmaster (1989) also reported the occurrence of iron encrustation on the artifactual material from the lower zone, similar to that reported from the Barnes site (Voss 1977) and from Archaic sites in other parts of the central Upper Peninsula (Anderton 1999).

Cultural material recovered from the Paquette site consists largely of stone tools made from locally derived quartzites, including a large projectile point with shallow side notches, numerous large bifaces, unifaces, scrapers and several thousand flakes. Chert artifacts include a large well-made drill, gravers, a variety of side and end scrapers, utilized flakes and cores, plus a moderate amount of debris. While only a small number of Hixton silicified sandstone flakes were found, Paquette (1986b) reported finding the base and mid-blade portion of a broken Plano lanceolate projectile point that appears to be made from Hixton silicified sandstone. According to Buckmaster (1987:456), the site assemblage closely resembles the early materials found at the George Lake I, George Lake II, and Sheguiandah sites located on the north shore of Lake Huron (Greenman and Stanley 1943; Lee 1954, 1955). However, Buckmaster also recognized similarities between the Paquette site lithic assemblage and the Lakehead Complex materials recovered from a number of early sites located near Thunder Bay, Ontario (Fox 1975; MacNeish 1952).

Negaunee Site

The Negaunee site (20MQ32) is located on the northeast shoreline of Teal Lake, a medium-sized inland lake located within the city limits of Negaunee, Michigan (Figures 9.1 and 9.2). The site was first investigated in 1984 by Paquette (1985) and marked the first discovery of potentially early cultural material in Marquette County. The Negaunee site is situated between two large outcrops of Ajibik quartzite formations that show signs of prehistoric quarrying activity. Although historic mineral exploration activity has disturbed portions of the site, limited surface collecting, shovel testing, and test excavations completed in 1985 by Northern Michigan University revealed a predominance of fire-cracked rock fragments, thick irregular flakes and shatter of locally available Ajibik quartzite (Buckmaster 1985). A number of large and crudely made scrapers, unifaces, bifaces and biface fragments were recovered, as were

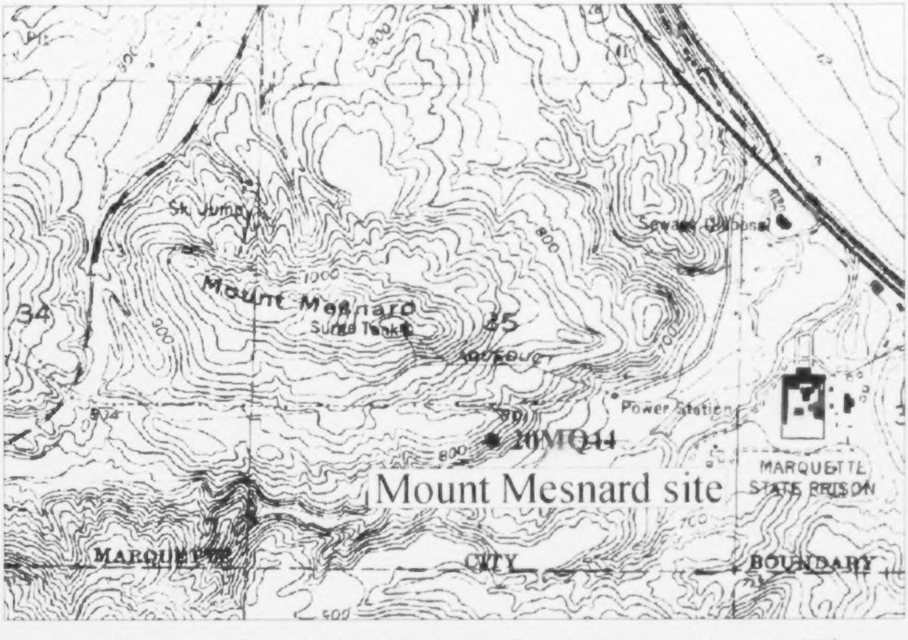

Figure 9.5 Mount Mesnard Site Location. Map excerpt is from USGS 1:24,000 Marquette, Mich. Quadrangle (1954, Photo-Revised 1975).

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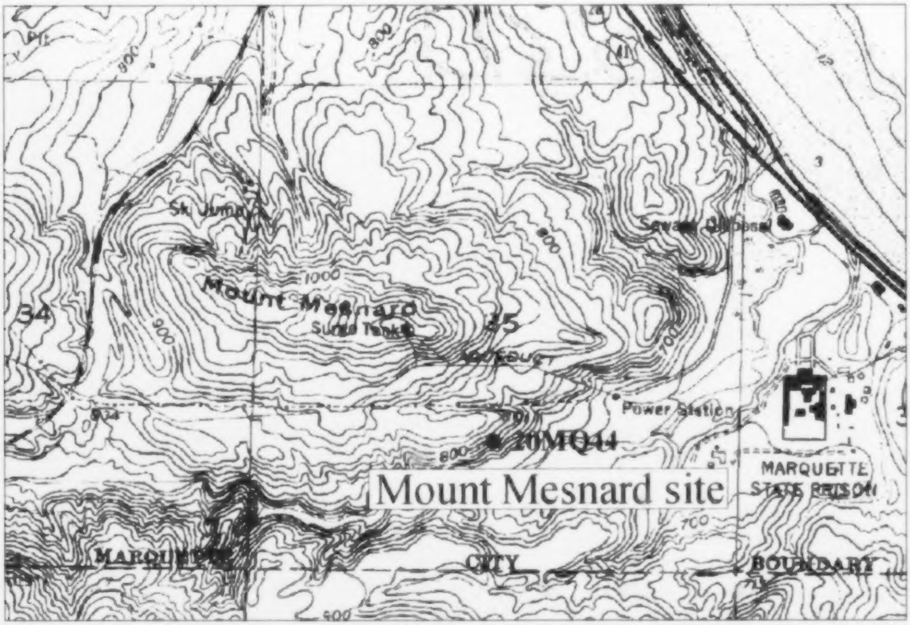

Figure 9.5 Mount Mesnard Site Location. Map excerpt is from USGS 1:24,000 Marquette, Mich. Quadrangle (1954, Photo-Revised 1975).

large, core-like chopper tools. In addition, two questionable projectile point bases were also recovered. Chert and quartz artifacts included several small scrapers and numerous flakes and cores. Several small and medium-sized flakes of Hixton silicified sandstone were also found.

The tool assemblage from the Negaunee site revealed some similarity to other early human sites in Ontario and northeastern Wisconsin (Mason 1981; Fitting 1970; Lee 1954), prompting suggestions for an early date (Buckmaster 1985). The presence of Hixton silicified sandstone flakes also hints at an early occupation. However, this association is complicated by the recovery of numerous copper tools and hammered fragments by local residents at the site prior to the academic investigation. The majority of the copper artifacts, including awls, projectile points, and a large well-made pike, were reported found only in the disturbed context, so their relationship to the quartzite and the other lithic materials remains unclear. No temporally diagnostic artifact styles were identified, which makes age estimates tenuous at best. However, minimal evidence such as the artifact assemblage, the choice of quartzite as the preferred lithic raw material, quarrying activities, and the presence of Hixton silicified sandstone, does suggest that the site is relatively early and that it likely has a Late Paleo-Indian component.

Mount Mesnard Site

The Mount Mesnard site (20MQ64) is a large prehistoric quartzite quarry and lithic workshop site located on the southeast flank of Mount Mesnard overlooking Lake Superior near the mouth of the Carp River (Figures 9.1 and 9.5). The site, which was discovered and reported by Paquette (1988) and further investigated by Northern Michigan University in 1991 and 1992 (Buckmaster, 1997), is also located within the city boundary of Marquette, Michigan. The initial surface investigation at the site revealed thousands of Mesnard Quartzite flakes, cores, and shatter fragments plus numerous hammerstones, broken bifaces, quarry blanks and modified flakes lying amidst exposed surface outcrops of fine-grained Mesnard quartzite. Controlled surface collecting and limited test excavations by NMU likewise produced a large assemblage of lithic tools, cores, and various types of flakes, plus one possible lanceolate projectile point base, all made of Mesnard quartzite.

Although the combined assemblage consists of non-diagnostic tools and debris, it bears a striking similarity to materials recovered at the George Lake and Sheguindah sites (Buckmaster 1997). In addition, Mesnard Quartzite has also been identified at number of suspected Late Paleo-Indian/Early Archaic sites in Marquette County, which may indicate that this material was being quarried at the Mount Mesnard site at a very early date. However, Buckmaster (1997:11) reported that two charcoal samples taken from a deeply buried feature located on the terrace above the quarry site, produced C^{14} dates of 5,280 B.P. and 5,270 B.P. (no further information available). Buckmaster (1997) further noted that buried cultural material on the terrace continued well below the depth of this feature. Consequently, the establishment of maximum dates for the initial use of this quarry site by early human groups to procure lithic material for tool making remains open for debate.

Proposed Site Dating

The recovery of three distinct Late Paleo-Indian projectile point types – Agate Basin, Hell Gap, and Cody/Scottsbluff – from Marquette County's Silver Lake, provided Buckmaster and Paquette (1996) with a much needed basis from which to formulate a proposed chronological sequence of Plano tradition adaptations in the central Upper Peninsula of Michigan. Citing technological and stylistic similarities between the Silver Lake and Deer Lake Plano diagnostics with their High Plains counterparts, Buckmaster and Paquette (1996) employed cross-dating techniques to tentatively identify the approximate temporal positions of the various Late Paleo-Indian complexes identified in the central Marquette County area.

Based on a compilation of radiocarbon dates, stratigraphic evidence and associated data from the High Plains, Buckmaster and Paquette (1996) suggested that the earliest Late Paleo-Indian projectile point tradition represented on Silver Lake was Agate Basin, followed in sequence by Hell Gap and then Cody/Scottsbluff materials (see Table 9.1). Agate Basin should date to between 10,500 to 10,000 B.P., while Hell Gap is slightly later in time with dates ranging from between 10,000 to 9,500 B.P. (Frison 1978; Frison and Stanford 1982; Irwin-Williams *et al.* 1973; Morrow 1986). Although dates for Cody/Scottsbluff on the High Plains range from 9,200 to 8,500 B.P., Buckmaster and Paquette (1996:44) indicated that more likely dates for Great Lakes Cody were from 9,400 to 9,000 B.P.

Paleoenvironmental Interpretations

Silver Lake Locality

As mentioned earlier, prior to the effects of damming in the early 20th Century, Silver Lake Basin consisted of a large inland lake, which formed part of the headwaters for the Dead River (see Figures 9.1 and 9.3). Silver Lake was initially exposed during Greatlakean ice retreat. Sometime between 11,850 and 11,000 B.P., Greatlakean ice is thought to have cleared the present south shore of Lake Superior (Farrand and Drexler 1985; Regis 1997). This chronology indicates that Silver Lake became available for human occupation sometime during the Gribben phase (Karrow *et al.* 2000), the interval between Greatlakean retreat and the re-advance of Marquette ice. It is also likely that large blocks of ice stagnated and occupied the Silver Lake basin for some time as Greatlakean retreat took place and this persisted for perhaps up to several centuries.

Based on the presence of prominent topographic scarps, Mooers (1994:810) suggested that as many as three ice marginal lakes also filled the Silver Lake basin during this retreat. A glacial spillway, which formed a large glacial outwash plain called Mulligan Plains, was present immediately east of Silver Lake. However, it is unlikely that any drainage reached the lake basin, as a very high ridge on the east side of the lake probably acted as a barrier to westward moving meltwaters. Given the regional dating of deglaciation (Farrand and Drexler 1985) and adjustments for stagnating ice blocks and ice marginal lakes, we suggest the earliest possible human occupation of Silver Lake was sometime between 11,000 and 10,500 B.P. Silver Lake basin was never directly glaciated again following the Greatlakean ice retreat, although the Marquette Advance ice did approach to within several kilometers to the east and north at about 10,000 B.P. The Yellowdog Plains, a prominent glacial outwash plain located about 5 km north of Silver Lake, formed at this time. No definite Marquette Advance drainage is traceable into the Silver Lake basin; however, periglacial conditions undoubtedly affected the basin until Marquette Advance ice retreated into the Superior basin sometime after 9,850 B.P. Although Mooers (1993) offered no definitive interpretations of maximum age of occupancy for the Silver Lake basin, Dobbs and Breakey (1994:6) indicate that the area was glaciated between 9,900 and 9,400 B.P. This interpretation cannot be correct. While the area to the east of Silver Lake was glaciated during the Marquette Advance, the basin proper was likely only indirectly affected at this time.

Deer Lake Locality

Like the Silver Lake Basin to the north, the Deer Lake Basin was created by historic damming to provide hydroelectric power to the nearby iron mines (see Figures 9.1 and 9.2). Prior to this human impact, the basin consisted of several small ponds and lakes, which formed the upper reaches of the Carp River, a tributary to Lake Superior. The Deer Lake area was also exposed during Greatlakean retreat, sometime between 11,850 and 11,000 B.P. Based on the presence of wave-cut benches at 490-meter contour level, Mooers (1994:8) has suggested that Deer Lake, Silver Lake and Dead River were all occupied by a large ice-marginal lake, as Greatlakean ice reached a marginal position to the east of the highlands of northern Marquette County. These 490-meter benches are not obvious on topographic maps, but based on the occurrence of prominent bluffs at this elevation in the Deer Lake area and to the north, it does seem likely that ice marginal lakes reaching an elevation of approximately 425 meters, were present. Since Deer Lake is slightly farther away from the Lake Superior shoreline and closer to the maximum position of Greatlakean ice, it may have been exposed slightly earlier than Silver Lake. Therefore, given the presence of ice marginal lakes and assuming a uniform rate of glacial retreat, we suggest that the earliest possible human occupation of Deer Lake is sometime between 11,000 and 10,500 B.P.

Deer Lake was not glaciated or affected by associated meltwater drainage during the Marquette Advance and has thus stayed ice-free for at least the last 10,500 years. Marquette Ice probably did approach within 10 km to the east of Deer Lake, suggesting that strong periglacial affects probably did occur at about 10,000 B.P. In their report on the Gorto site, Buckmaster and Paquette (1988:103) postulated that any occupation of the Deer Lake area prior to 9,500 B.P. was unlikely, due to the close proximity of the Marquette Advance ice and its related harsh climate. However, in a later work Buckmaster and Paquette (1996) recognized that the retreat of the Greatlakean ice sheet from the Upper Peninsula between 11,000 and 10,500 B.P. determined the earliest possible date for the initial occupation of their study area. They also presented strong evidence that Late Paleo-Indian peoples were in fact, occupying an active ice front in the central Marquette County area. Thus, the possibility exists that one or more of the early Deer Lake Locale sites was occupied either prior to or, during the time of, the Marquette Advance. It is very possible that the locale was also occupied for a period of time as ice retreated from its maximum position during the Marquette Advance, as evidenced by the presence of Cody Complex and side-notched Early Archaic projectiles.

Paquette Site (Goose Lake) Locality

Unlike the Silver Lake and Deer Lake localities, the Paquette Site is associated with a natural inland lake (see Figures 9.1 and 9.4). It was also exposed during Greatlakean retreat sometime between 11,850 and 11,000 B.P., and we suggest that like the other lakes mentioned in this study, the earliest human occupation of Goose Lake was possible sometime between 11,000 and 10,500 B.P. The lake basin is a glacially scoured bedrock depression surrounded on the north, south, and east by bedrock-cored highlands. A narrow gap in these highlands is present on the lake's southeast end and is blocked by glacial materials, which were likely deposited during Greatlakean retreat. These materials acted to block drainage and create an early phase of Goose Lake, which may have been ice-marginal for at least part of its duration. Prominent bluffs interpreted as shoreline features, with basal elevations at about 390 meters (1280 feet), are traceable around the north, south, and east margins of the lake. These bluffs extend to the northwest away from the lake for several kilometers, which suggests that the paleolake may have extended as far north and west as the southern margins of the present-day town of Negaunee.

A portion of the Paquette site is located on a remnant of another lake terrace, which likely encircled the Goose Lake basin, but at a slightly lower elevation. The base of the terrace is at about 378 m (1240 feet) and other segments of this terrace are present on the west and north side of the lake. Although dating is unclear, a lake that was approximately 6 to 7 meters higher than the current level of Goose Lake (371 m, 1218 feet) cut this terrace. It may have been an ice marginal lake; however, more detailed fieldwork is needed before definitive statements concerning site formation and dating can be made.

Negaunee Site

The Negaunee site, which is closely associated with outcrops of quartzite, is located at an approximate elevation of 420 m (1378 feet) on the northeast shore of Teal Lake, a natural inland lake located in the City of Negaunee (see Figures 9.1 and 9.2). Teal Lake occupies a deep basin between rock outcrops on its south and north sides. The east end of the lake basin is formed by the edge of an extensive outwash plain with surface elevation of about 428 m (1400 feet). Alternatively, the west end is formed by a deposit of glacial-fluvial material with large kettles at 347 m (1440 feet) sandwiched between outcrops of rock. The glacial drift that forms the east and west shores of the lake were deposited as Greatlakean ice retreated across the study area. Thus, the Negaunee site was first available for human occupation following the Greatlakean retreat, sometime between 11,850 and 11,000 B.P. Segments of terrace scarps, present on the south and east side of Teal Lake at an elevation of about 420 m (1380 feet), were likely cut by wave action from an earlier and larger ancestral stage of Teal Lake. This terrace may have been cut by wave action from a Greatlakean ice marginal lake.

Finally, the Negaunee Site was not directly touched by the return of Marquette Advance ice. However, the site was probably within 10 to 15 km of the maximum position of the ice at about 10,000 B.P., which suggests that strong periglacial conditions probably existed for at least a couple of hundreds of years before and after the Marquette Advance.

Mount Mesnard

The Mount Mesnard site is located on a steep cliff on the south side of a large outcrop of Mesnard Quartzite, which overlooks the mouth of the Carp River, near the shore of Lake Superior (see Figures 9.1 and 9.5). Mount Mesnard was also exposed following Greatlakean deglaciation, but since it is located farther east than any of the other site locales it was likely exposed somewhat later. Consequently, the site location may not have been available for human use until closer to 11,000 B.P. The outcrop was then covered by the ice of the Marquette Advance and wasn't exposed again until sometime shortly after 10,000 B.P. It is unclear where the Main Minong shoreline was in relation to the site; however, the steep valley located immediately to the south may have been cut or at least modified by post-Minong down cutting of the ancestral Carp River. A probable paleo-delta surface, graded to the level of the Nipissing Shoreline (195m, 640 feet), is present at the base of the prominent bluff where the site is located. These deltaic deposits are ca. 4,700 B.P. in age, making it a possibility that Late Paleo-Indian and subsequent Early and Middle Archaic quarry debris may be buried under the Nipissing-related deposits at the base of the cliff.

Discussion: Geoarchaeological Context

The connection between Late Paleo-Indian people and the paleoenvironment of the Upper Great Lakes has received much attention over the last sixty years (Greenman and Stanley 1943; Fitting 1970; Mason 1980). The situation in the north central Upper Peninsula is especially intriguing given the recent discoveries of early archaeological sites (see Table 9.2) and the relatively well-documented record of Late Pleistocene deglaciation (see Table 9.1). Indeed, the discovery of the Gorto site prompted Buckmaster and Paquette (1988) to suggest that the site may have been occupied during the time of the Marquette Advance. Based on the archaeological similarities to other sites in the region and geological evidence that Goose Lake and the immediately adjacent hills remained ice free during the Marquette Advance, Buckmaster (1989) later proposed that the Paquette site was initially occupied by Late Paleo-Indian peoples prior to the retreat of the Marquette ice sheet. Still later, Buckmaster and Paquette (1996) further speculated on the relationship of the timing of late glacial events in the Lake Superior Basin and the presence of Late Paleo-Indian peoples in northern and central Marquette County. This speculation led to the conclusion that local Agate Basin and Hell Gap projectile point traditions were probably contemporaneous with the final glaciation of the area by the Marquette Advance, and that Cody/Scottsbluff complex peoples occupied the region during earliest Holocene.

Given the detailed analysis of the deglacial history and, assuming the estimates of archaeological site dating are correct, it would seem that people may have entered the region between approximately 11,000 and 10,500 B.P., immediately following the Greatlakean ice retreat. Plano people certainly occupied the region during and immediately following the Marquette Advance. In particular, people with an Agate Basin projectile point tradition occupied the area during the Gribben Phase between approximately 10,500 and 10,000 B.P., prior to, and up to the maximum position of the Marquette Advance ice on the modern south shore of Lake Superior (see Table 9.1). Although only Silver Lake has documented sites from this period in the Marquette County area, it is likely that Agate Basin people were present as ice filled the Superior Basin and advanced across the south shore of the lake. Such a setting must have presented increasingly worsening periglacial conditions, as evidenced by the decrease in tree ring thickness over the final 200 years of growth for the trees in the Gribben buried forest in southwestern Marquette County (Pregitzer *et al.* 1999). Ice marginal lakes created during the Marquette Advance may have offered attractive habitation areas like those on the terrace at the Paquette site. The Hell Gap projectile point tradition seems to have been contemporaneous with the Marquette Advance (see Table 9.1), suggesting that people were living at least 10 to 15 km away from an active ice front. However, the Marquette ice was probably in a period of retreat for much of this time period (between 10,000 and 9,500 B.P.). Glacial Lake Minong (Main Minong) probably offered attractive shoreline settings as the ice retreated to the north across the Superior Basin. The situation of Paleo-Indian people living along an active ice front and/or ice marginal glacial lakes is not unheard of as workers in the northwestern part of the Superior basin have made similar suggestions (McLeod 1995, 2000; Phillips and Hill, this volume). Finally, people with the Great Lakes Cody projectile point tradition occupied the study area following the end of the Minong Phase, at a time when lake levels were dropping to the Houghton Low. Large areas of exposed land along the south shore of the Superior Basin were revealed at this time, between 9,500 and 9,000 B.P. Deep incision of river valleys also occurred as base levels experienced massive drop in elevation. Much of the newly exposed land would later be submerged by the Nipissing transgression. Indeed, a considerable part of the landscape that was available to Cody people is currently under the modern levels of Lake Superior (see Phillips 1993).

Like anywhere else, archaeologists doing survey work in the Marquette area must pay special attention to the age of landforms. If the scenario of site dating presented here is correct, Marquette Advance age landforms hold the potential to have only Hell Gap, Cody Complex, and later materials associated with them. In contrast, Greatlakean retreat landforms have the potential to contain material at least as old as Agate Basin and later materials. In essence, this "archaeological discontinuity," as recognized by Phillips (1993) for the Lake Superior Basin, must be considered when efforts are made to determine the earliest possible human occupation of localities in the study area.

Further, the settings of Late Paleo-Indian sites in the Marquette area differ somewhat from the findings in other areas of the Lake Superior basin. As Ross (1995:244) suggests, "the lateness of the glacial retreat in the area and the spreading of large glacial lakes has partially determined not only the geographical location of many sites but also the broad cultural sequence to which they belong." Whereas many of the better known sites in the Lakehead Region of northwestern Lake Superior are generally associated with ancient shorelines (Phillips 1988), most of the sites in the north central Upper Peninsula do not present such a strong settlement connection to paleoshorelines of the ancestral Great Lakes. In most cases, the sites in Marquette County have been found associated with inland lakes. This is similar to the findings in the Wisconsin North Lakes area (Salzer 1974), the Island Lake area of northern Minnesota (Harrison *et al.* 1995), and the Arrow-Whitefish Lakes area (Phillips and Hill, this volume) west of Thunder Bay, Ontario. While it is tempting to suggest that Plano settlement in Marquette County focused purely on inland lake settings, the recent site discoveries are more likely a consequence of site visibility, often the result of large reservoirs being drawn down for various reasons. Such a situation reflects the nature of archaeological sampling, rather than a representative sample of the full range of possible site settings within the Late Paleo-Indian settlement pattern.

Although archaeologists working in the north-central Upper Peninsula have not yet found any Early Paleo-Indian sites, they must be made aware of their possibility in deeply buried context. Given the geological history of the area, it is quite possible that archaeological sites containing Agate Basin or older material may be found under Marquette Advance drift. Because lake levels during the time between Glacial Lake Minong and Rising Nipissing were extremely low for the Superior basin, Great Lakes Cody materials could potentially be found under Nipissing transgression deposits in the Marquette County area. This has certainly been the case in other locations within the region (Phillips 1993).

Conclusion

Since 1985, several Late Paleo-Indian archaeological sites have been found in the central and northern portion of Marquette County, in the Upper Peninsula of Michigan, USA. Analysis of the Late Quaternary chronology and associated landforms, as well as paleoenvironmental reconstructions, reveals that Late Paleo-Indian people probably entered the area as Greatlakean ice retreated into the Lake Superior Basin beginning as early as 11,000 to 10,500 B.P. Plano people, as represented by the Agate Basin (ca. 10,500 to 10,000 B.P.) and Hell Gap (10,000 to 9,500 B.P.) projectile point traditions, were present in the area during the Gribben (interstadial) phase and appear to have been living within 10 to 15 km of an active glacial front during the Marquette (stadial) Advance (ca. 10,000 B.P. maximum). They were also present during the retreat of Marquette ice from the south shore of Lake Superior. People from the Great Lakes Cody (Scottsbluff/Eden 9,400 to 9,000 B.P.) projectile tradition occupied the area immediately following the retreat of Marquette ice, as lake levels dropped from the Main Minong phase to the Houghton Low.

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10.

Deglaciation History and Geomorphological Character of the Region Between the Agassiz and Superior Basins, Associated with the 'Interlakes Composite' of Minnesota and Ontario

Brian A.M. Phillips and Christopher L. Hill

Abstract

As the Des Moines, Rainy and Superior ice lobes withdrew from Minnesota and the Superior Basin after 12,000 B.P., Palaeo-Indian people moved into the region of northeastern Minnesota and northwestern Ontario, which lies between the sequence of lake phases in the Lake Agassiz and in the Superior basins. Scattered evidence of the 'Interlakes Composite' is associated with interior lakes, rivers and topographic features such as moraines. However, migration also appears to have consistently followed the changing geography of the Superior and Agassiz lake shorelines, which provides an inexact but useful tool for relative dating. New geomorphic evidence suggests that conditions would have allowed Palaeo-Indians to enter the borderland region prior to the Marquette readvance of around 10,025 B.P., and possibly as early as before 11,000 B.P.

Résumé

A mesure que les lobes glaciels Des Moines, Rainy et Supérieur se sont retirés du Minnesota et du bassin Supérieur anterieur à 12 000 A.A., la population paléoindienne s'est déplacée dans la région nord-est du Minnesota et nord-ouest de l'Ontario, qui s'étend entre la suite des phases lacustres dans les bassins du lac Agassiz et Supérieur. L'évidence dispersée de la « Composite Interlacs » est associée aux lacs à l'intérieur des terres, les rivières et les traits topographiques telles que les moraines. Cependant, il parait aussi que la migration de la population paléoindienne a régulièrement suivie la géographie variable des zones côtières des lacs Agassiz et Supérieur, ce qui devient un outil inexact mais toutefois utile à la calibration

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d'une date relative. Des nouveaux indicateurs géomorphologues suggèrent que les conditions ont permit à la population paléoindienne de pénétrer la région limitrophe avant le retour du glacier Marquette vers 10 025 A.A. et peut-être aussi tôt que 11 000 A.A.

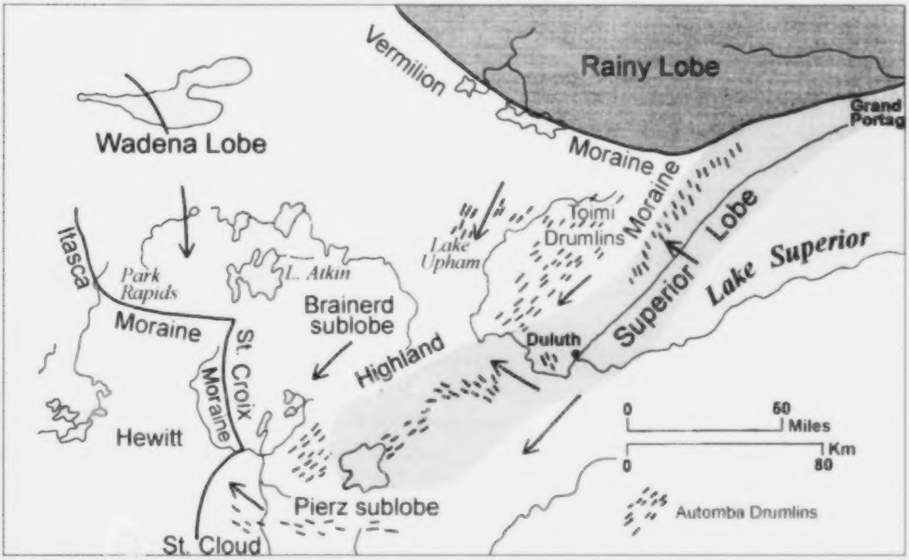
Introduction

As the Des Moines, Rainy and Superior ice lobes gradually withdrew from central Minnesota, a corridor of freshly deglaciated landscape was revealed that led through northeastern Minnesota into northwestern Ontario, between the extensive area of Lake Agassiz to the north and the declining sequence of lakes occupying the Superior basin to the south. Into this corridor migrated groups of Palaeo-Indians, who it appears, followed closely on the heels of deglaciation. The landscape that early arrivals traversed was one that was periglacial but often flowing with an abundance of meltwater. Large proglacial lakes occupied some areas along the northern side of the corridor, temporarily cascading to lower basins and gradually shrinking in their dimensions. The myriad of lakes in the interior of the corridor probably filled their basins to a much greater degree than at present, and along the southern edge of the corridor the lakes of the Superior basin penetrated far inland of the present lake margin. The people who entered the rugged and still changing landscapes of this corridor came from more southern environments. McLeod (1976, 1981) discussed the perception of the Boreal Forest (1982), and he characterized these peoples as highly mobile family units, sharing traditional sites on a seasonal or sporadic basis. Their adaptation to the conditions of the new region, as evidenced by their toolkit, has resulted in their being identified as the 'Interlakes Composite' (Ross 1997), a term which expanded that of the 'Lakehead Complex' (Fox, 1975). They left a limited, varied and often confusing deposition of artifactual materials (Mcleod 1976) spanning several cultural traditions. The characteristics of their projectile point styles and the variety of raw materials they utilized is discussed by Ross (1995).

Based on the presence of a Clovis point at the Island Lake site, Minnesota, it has been proposed that Palaeo-Indian populations began to occupy parts of northern Minnesota by about 10,500 B.P., and perhaps as early as 11,000 to 10,800 B.P. (Romano and Johnson 1990; dating based on Haynes 1993, see also Holliday 2000). This paper provides evidence, which suggests the potential for such early occupation as far north as Cook County, Minnesota and into the Canadian borderlands, just southwest of Thunder Bay, Ontario.

Deglaciation Summary

Several major phases of late-Wisconsin glacial activity have been distinguished in northeastern Minnesota (Wright and Watts 1968; Lannon and Matsch 1987; Lehr and Hobbs 1992). The three major advances, in chronological order, are the St. Croix phase, the Automba phase and the Nickerson-Alborn phase. Dates quoted here may have to be revised (for example, see Mooers and Matsch 1998).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Moraine
Rainy Lobe
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Toimi Drumlins
Lake Upham
L. Atkin
Itasca
Park Rapids
Moraine
Brainerd sublobe
Superior Lobe
Lake Superior
St. Croix Moraine
Highland
Duluth
0
50
Miles
Km
0
80
Hewitt
Pierz sublobe
Automba Drumlins
St. Cloud

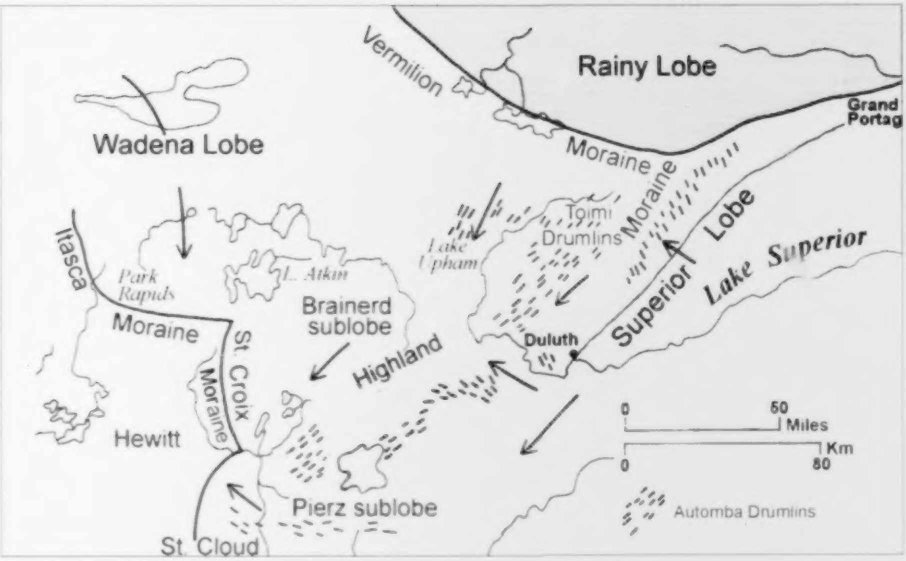
Figure 10.1 St. Croix phase deglaciation began after 20,000 years B.P. The Superior lobe reached into central Minnesota to form the St. Croix Moraine. By 12,500 yrs. 14C yrs B.P. the Rainy lobe had melted back to the Vermilion Moraine - Automba phase deglaciation. The Mille-Lacs-Highland Moraine marks the extent of the Superior lobe (After Phillips, Hill, Fralick and Ross, 1994, p.6E).

St. Croix Phase

During the St. Croix phase, the Superior and Rainy lobes combined and advanced south and west to build the St. Croix Moraine, between approximately 20,000 and 15,000 B.P. (Clayton and Moran 1982; Mickelson *et al.* 1983:10; Attig *et al.* 1985) (Figure 10.1). In the interstadial that followed, the Rainy lobe melted back to the Vermilion Moraine (Wright and Watts 1968:13), proglacial lakes Upham and Aitken I were formed, and the Superior lobe melted back into the Superior basin.

Automba Phase

The Automba phase (Figure 10.1), estimated to have occurred 17,000 to 15,000 B.P. (Wright and Watts 1968), saw the Rainy lobe remain in the vicinity of the Vermilion Moraine, but the Superior lobe advance southwest to build the Mille Lacs Moraine and push up the coastal slopes of the north shore across the southeastern edge of the Toimi drumlin field to form the Highland Moraine, sub-parallel to the Superior lakeshore. This appears to represent the greatest identifiable incursion of the Superior lobe across the north shore and, although the Highland Moraine is not traceable as a feature north of its junction with the Automba margin of the Rainy lobe, the inland margin of the red Superior till can be traced up the shore towards Grand Portage about 2 to 4 miles inland (Figure 10.2). In several locations within the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Grand
Portag
Wadena Lobe
Moraine
Itasca
Park
Rapids
L. Atkin
Lake
Upham
Toimi
Drumlins
Moraine
Lobe
Superior
Lake Superior
Brainerd
sublobe
Moraine
St. Croix
Moraine
Highland
Duluth
Hewitt
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50
Miles
0
80
Km
Pierz sublobe
St. Cloud
Automba Drumlins

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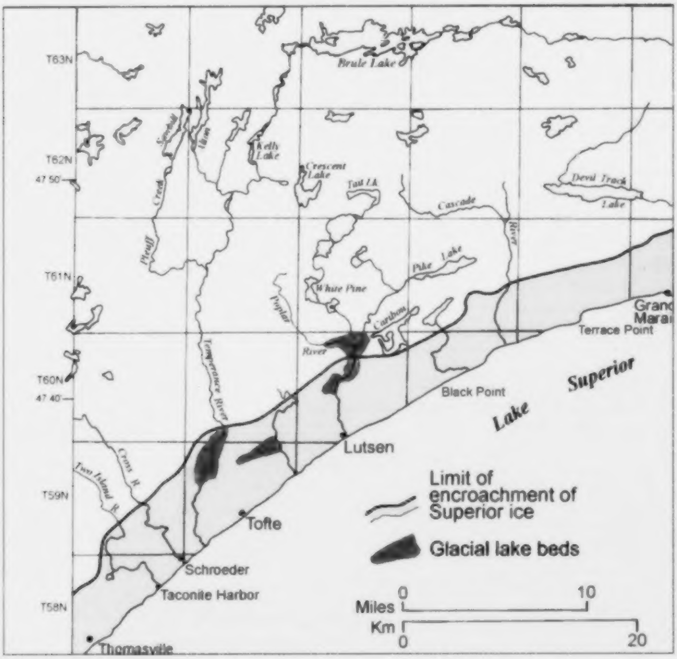
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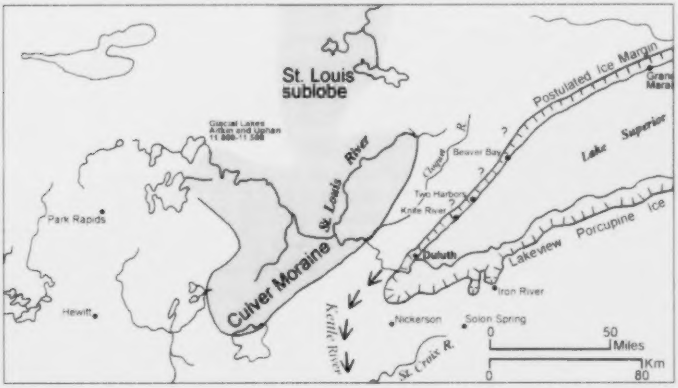
T58N
Brule Lake
Kelly Lake
Crescent Lake
Tait LK
Devil Track Lake
Cascade
River
Pike Lake
White Pine
Poplar
Caribou
River
Temperance River
Creek
Cross R.
Two Island R.
Gran
Marai
Terrace Point
Black Point
Lake Superior
Lutsen
Tofte
Schroeder
Taconite Harbor
Thomasville
Limit of encroachment of Superior ice
Glacial lake beds
Miles 0 10
Km 0 20

Figure 10.2 Proposed Limit of the Superior Lobe on the North Shore of Lake Superior (After Sharp, 1953b, Figure 2).


St. Louis sublobe
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Beaver Bay
Two Harbors
Knife River
Duluth
Postulated Ice Margin
Gran
Marai
Lake Superior
Lakeview Porcupine Ice
Iron River
Park Rapids
Hewitt
Nickerson
Solon Spring
Kettle River
St. Croix R.
0 50 Miles
Km 0 80

Figure 10.3 Nickerson-Alborn Phase Deglaciation. Around 12,000 years B.P. the St. Louis sublobe advanced from the northwest to form the Culver Moraine. The Nickerson Moraine marks the extent of the Superior lobe. Later, the Lakeview/Porcupine phase of deglaciation saw water from glacial lakes Aitkin and Upham II flow through the St. Louis drainage system (After Phillips, Hill, Fralick and Ross, 1994, p.7E; Phillips and Hill, 1994a, p.18).

deep valleys of the north shore, the red Superior till has been observed to overlie grey, carbonate-rich Rainy till (Sharp 1953b:861). At the end of the Automba phase, the Superior lobe retreated into the Superior basin allowing red lacustrine clays to be deposited in the southwest end of the basin in an incipient Lake Duluth or Epi-Duluth lake.

Nickerson-Alborn Phase, Lakeview/PorcupinePhase

The subsequent Nickerson-Alborn phase saw the St. Louis sublobe of the Des Moines lobe readvance over the basins of Glacial Lakes Aitken and Upham about 12,000 B.P. (Figure 10.3). The Superior lobe again advanced southwest over the lacustrine floor to build the Thompson-Nickerson Moraine, about 12,000 to 11,000 B.P. It is significant that there is no clear evidence of the degree to which this ice impinged along the north shore. This is also true of a minor subsequent advance of the Superior lobe, the Lakeview/ Porcupine phase about 11,000 B.P. (Figure 10.3), athough some evidence of an ice margin just to the west of Two Harbors is recorded (Clayton 1984:32–33). More lacustrine clays were deposited in ice marginal lakes of Epi-Duluth type. Human populations using Clovis artifacts may be associated with the ice margins of the Lakeview/Porcupine phase, if Palaeo-Indian people had entered the area by 11,000 B.P.

Early Minong Levels and Marquette Phase

Following the Lakeview/Porcupine phase, melt appears to have been sufficient to have permitted the Superior lobe to vacate much of the Superior basin. Anderton *et al.* (this volume) refers to this ice in withdrawal in the Upper Peninsula of Michigan as 'Greatlakean'. Retreating to the Ontario north shore, it allowed the eastern outlets of Lake Agassiz to pour catastrophically over the Arctic divide and through Lake Nipigon into Early Lake Minong, the body of water occupying the Superior basin between about 10,800 and 10,000 B.P. (Teller and Thorliefson 1983) (Figure 10.4a). Little is known of Early Lake Minong. The Superior basin was still greatly depressed, and it would not be unreasonable to suggest that water levels were probably similar to that of the Epi-Duluth and Duluth lakes that followed the withdrawal of Marquette ice.

It is at this point in deglaciation history that conditions were favourable for early Palaeo-Indian occupation of the corridor, which had now expanded to include the exposed floor of Lake Agassiz during the accompanying Moorhead low water phase, and the Minnesota shores of Lake Superior, now fully freed from ice contact. This period or interstadial has been named 'Gribben' (Karrow *et al.* 2000) after the forest bed of Lake Gribben, Michigan, which grew during this period.

Evidence for the late stage Marquette Readvance (until recently pegged at 9,900 B.P.) is based upon the rise of Lake Agassiz (the Emerson phase) due to the sealing of the eastern Nipigon outlets (Fenton *et al.* 1983). Further evidence suggests late ice incursion on the coastal zone of Michigan and Wisconsin, where burial of forest growth by lacustrine and outwash deposits and isolated morainic features has been identified (Hughes and Merry 1978; Drexler at al. 1983; Clayton 1984) (Figure 10.4b). On the basis of additional ^{14}C dates from the Lake Gribben forest bed and correlation with ice advances elsewhere in the northern hemisphere, Lowell *et al.* (1999) confirm and refine what is known of the Marquette Advance. They

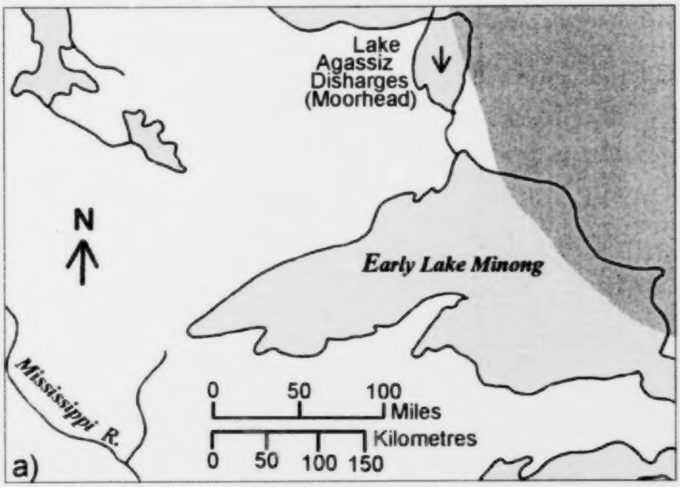

Lake Agassiz Disharges (Moorhead)
N
Early Lake Minong
Mississippi R.
0 50 100 Miles
0 50 100 150 Kilometres
a)

Figure 10.4a Superior basin, Early Lake Minong, about 10,400 yrs. 14C yrs B.P. Melting back of the Superior lobe allowed the basin to fill with a lake that was contemporaneous with the eastward draining of Lake Agassiz (Moorhead stage) (From Phillips, 1993, p.95).

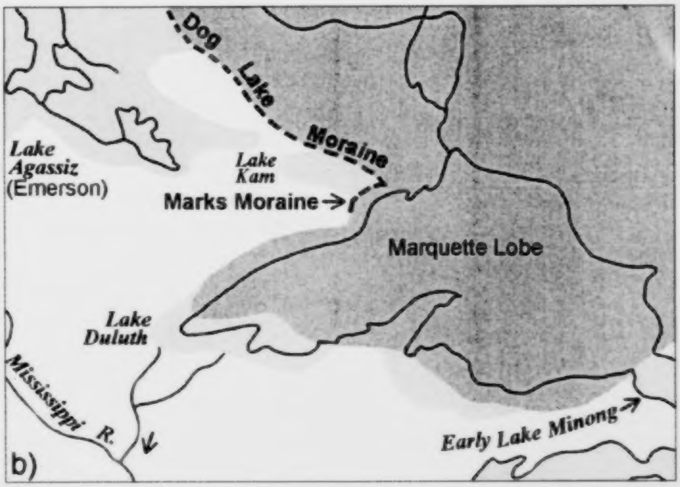

Dog Lake Moraine
Lake Agassiz (Emerson)
Lake Kam
Marks Moraine
Marquette Lobe
Lake Duluth
Mississippi R.
Early Lake Minong
b)

Figure 10.4b Superior basin, Marquette Readvance of Superior lobe, about 10,000 yrs. 14C yrs B.P. Blockage of the eastern outlets heralded the Emerson phase of Lake Agassiz. The Dog Lake and Marks Moraines trapped glacial Lake Kaministiquia, and Lake Duluth formed in the southwest end of the basin (From Phillips, 1993, p.95).

conclude that the advance lacks the character of a regional surge event on the edge of the Laurentide ice and is a later than average expression of the general advance of ice sheets in the Younger Dryas global cooling event that occurred approximately 11,000 to 10,000 B.P. They identify an advancing ice margin halting at 10,025 B.P. adjacent to the Gribben forest and extending over 1000 km from North Bay, Ontario, along the southern shore of Lake Superior towards Duluth.

West of Duluth the impact of the Marquette Advance is less clear. Evidence of the Marquette Advance on the Minnesota north shore is questionable, and the southwestern end of the Superior basin appears to have remained occupied by a vestige of Early Lake Minong, now termed Lake Duluth. Although possible evidence of overlapping variants of Superior till on the Minnesota north shore could be interpreted as the impinging of Marquette ice (Lehr and Hobbs 1992:51), there is the real possibility that the northwestern margin of the Marquette lobe remained offshore (contrary to Figure 10.4b). This allowed Lake Duluth to lie high against the coastal slopes at least as far north as the international border, north of which Marquette ice is considered to have extended up the Kaministiquia embayment to the position of the Marks Moraine (Farrand and Drexler 1985). It has been assumed by some authors, quite reasonably, that the Marquette Readvance would have obliterated any pre-Marquette shoreline archaeological sites along the Minnesota north shore (Phillips 1993), but such early sites could have been preserved if ice did not in fact, impinge heavily on the shoreline.

High Shorelines in Cook County, Minnesota

There remains a degree of uncertainty as to when and, at what elevation, the body of water named Lake Duluth was first formed. References to independent proglacial lakes formed at the southwest terminus of the Superior lobe vary in their estimation of lake level, chronology and nomenclature.

Early Lakes

Glacial Lake Nemadji and other smaller proglacial lakes are referred to as Epi-Duluth, and are generally believed to have coalesced into Lake Duluth as the ice margin receded. Farrand (1960) proposed that coalescence took place at the 331m (1085 feet) level, and later authors concur that the best developed Duluth shoreline features are displayed along the Skyline Parkway (in Duluth, Minnesota) between 330 and 327m (1083 and 1073 feet) (Zarth 1977:81; Moss *et al.* 1979:23; Phillips *et al.* 1994). Farrand determined that three distinct stages of Lake Duluth were displayed at 331, 328 and 323m (1085, 1075 and 1060 feet), all water planes appearing horizontal in the Duluth area, but gradually commencing tilt until approximately 0.502m per km (2.65 feet per mile) northeast of French River (Farrand 1960:22) (Figure 10.5). Farrand traced the 331m (1085 feet) level to just north of Grand Marais where it is found at 390–393m (1280–1290 feet) (Sharp 1953a), and suggests that the ice margin was close by. The 328m (1075 feet) level was traced to a feature approaching the international border near Mineral Center at 403m (1323 feet) (Farrand 1960:176). If this level of Lake Duluth is projected across the border it would be found close to 442m (1450 feet) near Thunder Bay, Ontario.

In the vicinity of the Brule River at Judge C.R. Magney State Park, just north of Grand Marais, the highest expected level of the 328m (1075 feet) stage of Lake Duluth is at about

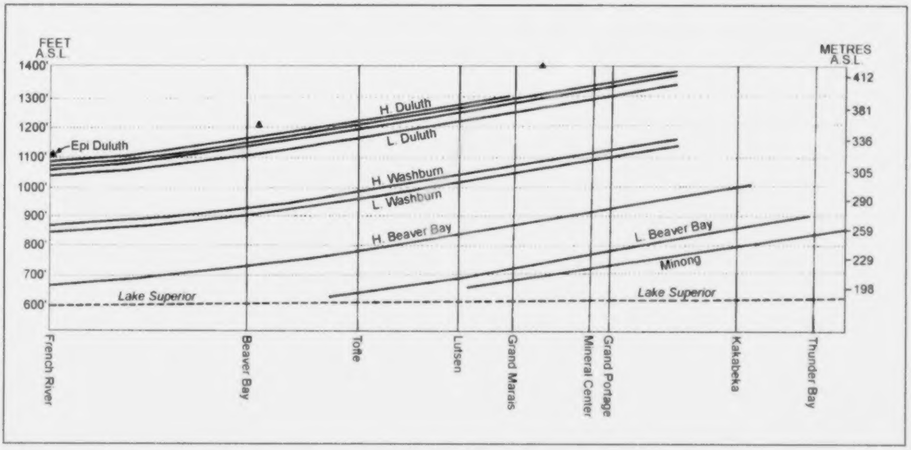


Figure 10.5 Shoreline diagram of the Epi-Duluth, Duluth and selected other shorelines. (After Farrand, 1960; Phillips, Hill, Fralick and Ross, 1994)

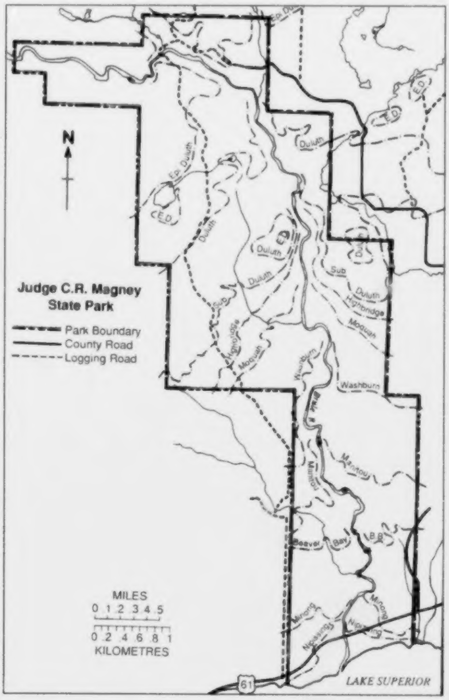
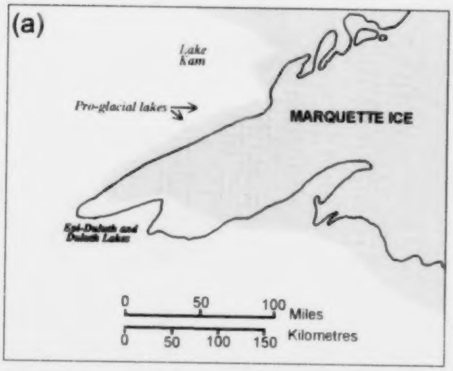
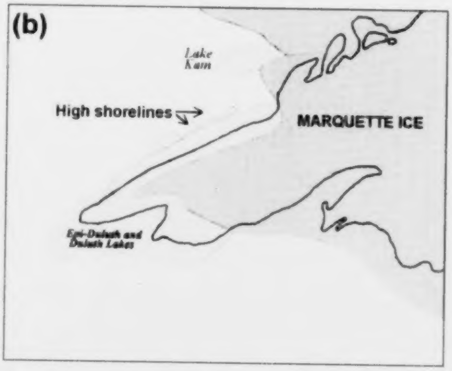

N
Judge C.R. Magney State Park
Park Boundary
County Road
Logging Road
Epi Duluth
E.D.
Duluth
Sub
Highbridge
Moquah
Washburn
Manitou
Beaver Bay
B.B.
Minong
Nipissing
MILES
0 1 2 3 4 5
0 2 4 6 8 1
KILOMETRES
61
LAKE SUPERIOR

Figure 10.6 Former Shorelines in Judge C.R. Magney State Park. (From Phillips and Hill, 1993, p.19)

396m (1300 feet), and fairly weak features are recorded at this level (Farrand 1960:175). However, remarkably well-developed shoreline features have been subsequently reported around 427m (1400 feet) in the Brule River area, within Judge C.R. Magney State Park (Phillips and Hill 1993) (Figure 10.6). Shorelines that are higher than Lake Duluth have also been reported in the Duluth area (Schwartz and Theil 1963:198), at Two Harbors (Lannon 1986), and in the vicinity of the Baptism River in Tettegouche State Park (Farrand 1960:168; Phillips and Hill 1994b) (Figure 10.5). These observations can be interpreted in several ways.

Three Shoreline Models


(a)
Lake Kam
Pro-glacial lakes
MARQUETTE ICE
Epi-Duluth and Duluth Lakes
0
50
100
Miles
0
50
100
150
Kilometres


(b)
Lake Kam
High shorelines
MARQUETTE ICE
Epi-Duluth and Duluth Lakes

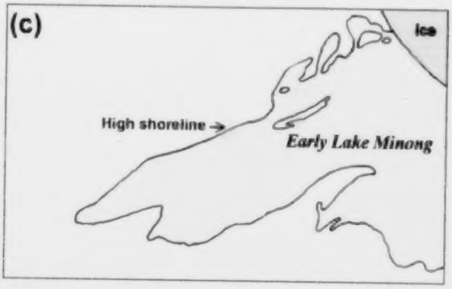

(c)
Ice
High shoreline
Early Lake Minong

Figure 10.7a The Isolated Lakes Hypothesis. In this model, independent drainages form separate proglacial lakes against the Marquette ice margin. Epi-Duluth and Duluth level lakes occupy the southwest of the basin. (From Phillips and Hill, 1994a, p.31)

Figure 10.7b The Narrow Lake Hypothesis. In this model, a high, narrow, lake (Epi-Duluth level) lies between the upland coast and the Marquette ice margin offshore. (From Phillips and Hill, 1994a, p.31)

Figure 10.7c The Large Lake Hypothesis. In this model, high shorelines are related to an Early Lake Minong as Superior ice vacated most of the basin and allowed Lake Agassiz to use the eastern outlets. *(this figure is new to this paper)*

Isolated Proglacial Lakes

The first possibility is that high shoreline features could have been formed in geographically isolated locations as a result of Superior ice impinging on the coastal slopes and damming major river valleys to form independent proglacial lakes (Figure 10.7a). As seen from the earlier discussion, determining which phase of Superior ice would have been responsible is a fair question, particularly since the presence of later Marquette ice on the shore is now questioned. The well-formed nature of the shorelines in Judge C.R. Magney State Park suggests that wave action in small, isolated lake bodies would have been insufficient to form the high shoreline features, especially when the Duluth shorelines below are themselves less well-formed.

A Narrow Lake Bounded by Ice (EPI-Duluth)

A second possibility is that the coalescence of Epi-Duluth proglacial lakes in the Duluth area involved a continuation up the north shore, such that a narrow ribbon of water was formed between the Superior lobe and the coastal slopes (Figure 10.7b). Being a single lake, the present discontinuous segments of this Epi-Duluth lake should demonstrate continuous deformation up shore; however, as yet, too few occurrences of these high water level features have been reported to verify this. However, the well-formed features at both Judge C.R. Magney and Tettegouche State Parks do indicate a tilt similar to that of the Duluth shorelines (Figure 10.5). Once again, it seems unlikely that these well-formed features developed in the limited wave environment offered by a narrow proglacial lake lying parallel to the shore.

A Large Open Lake (Early Lake Minong)

A third possibility is that the high shorelines were formed in an open lake environment without the inhibiting presence of ice (Figure 10.7c). This would have to be Early Lake Minong, the body of water occupying the Superior basin prior to the Marquette advance, and about which relatively little is known. This water body began forming as an early version of Lake Duluth in the southwest corner of the basin and ultimately filled the Superior basin as ice largely vacated it. It received catastrophic overflows from Lake Agassiz via the eastern outlets (Teller and Thorliefson 1983), but a fairly stable water level of the elevation seen on the north shore is not unreasonable. The Marquette Readvance could, in this scenario, have later invaded the lower coastal slopes, with the highest level of Lake Duluth failing to encroach on the former Early Lake Minong shoreline and therefore, permitting it to survive. This is conjectural and there is a need to determine whether this high shoreline level is in evidence elsewhere in the lake basin. Anderton *et al.* (this volume) note wave-cut features at 490m (1607 feet) and 425m (1394 feet) in the Deer Lake area, and other wave cut features at 428m (1400 feet) and 420m (1380 feet) near Teal Lake, both in Marquette Co., Michigan. However, it has not been established whether these were formed in isolated proglacial lakes or could have been part of the Early Lake Minong shoreline, prior to the Marquette Advance.

Archaeological Implications

The archaeological implications, especially of the third interpretation, are significant. If Palaeo-Indian people entered the Interlakes corridor in the Gribben period, prior to the Marquette advance (before 10,025 B.P.), then it is entirely possible that they would have migrated up the north shore, which would have served as a fairly obvious route. Evidence of their presence may lie waiting to be found on these high shorelines and also, inland of them.

If the second interpretation is more correct, then the presence of the Marquette lobe offshore may or, may not have inhibited the presence of Palaeo-Indians on the high Epi-Duluth shoreline. Alternatively, if the first interpretation is correct, it is still possible that people would be present on the shores of isolated proglacial lakes, unless nearby ice margins were, in fact, a deterrent to their presence. McLeod noted that the borderland area was open (ca. 12,000 to 11,000 B.P.) and stated that "The possibility that the first people into the area were tundra/parkland caribou hunters exists. This movement would have come from northern Minnesota" (1981:33). More recently (McLeod 1995), speaking of the Thunder Bay area alone, he concluded that Palaeo-Indians camped on the shores of proglacial lakes around 10,000 B.P. He suggested that these people lived within 10km (6.25 mi) of the glacial front. Anderton *et al.* (this volume) concur with Buckmaster and Paquette (1996) that Palaeo-Indian people may well have been living within 16 to 24 km (10–15 mi) of the active ice margin in Marquette Co., Michigan; therefore, it is not unlikely that artifacts may be found along this high shoreline, regardless of its relative origin and age. However, the third interpretation would see these sites representing pre-Marquette habitation of the Minnesota north shore.

Current evidence shows that the main migration of these early people followed the withdrawal of the Marquette lobe after 10,025 B.P.Their presence can be traced from Lake Duluth shorelines in the Duluth area (Mulholland and Dahl 1988), northeastwards to later shorelines of the descending series of post-Duluth shorelines, entering the Kaministiquia embayment, Thunder Bay, Ontario. This occurred most obviously after the late Beaver Bay water level, when Minong lake levels prevailed, around 9,500 B.P. (Phillips 1988; Stuart 1993). Although the association of ancestral Lake Superior shorelines with archaeological sites in the Thunder Bay area does provide convenient relative dating, the scenario of coastal migration does not exclude the possibility of earlier migration through the inland portion of the Interlakes corridor, prior to, and during the Marquette advance.

Deglaciation Features of the Borderland Region

It is significant that Sharp's map of glacial features in Cook County (Sharp 1953b:Fig.2; Grout *et al.* 1959:Plate 1) shows the undulating inland boundary of the Superior lobe sub-parallel to the shoreline as far north as Mineral Center (Figure 10.8). To the east, the boundary is lost in the rugged topography of the diabase ridges of the Grand Portage area, and its lacustrine red clay-floored valleys and hollows.

Morainic Features

STEEP ROCK AND BRULE MORAINES: On the Canadian side of the border, Zoltai (1963) identified several moraines (Figure 10.9). The earliest evidence of ice movement is the one advancing over the whole area from slightly east of north. This Patricia ice (as locally known) accords with the Rainy lobe advance to the St. Croix Moraine through northeastern Minnesota. During the retreat of this ice margin, the 'Greatlakean' retreat, the Steep Rock Moraine was formed sometime after ice withdrew from the Vermilion Moraine in Minnesota (Figure 10.1). The moraine does not visibly extend into the tip of northeastern Minnesota, athough its southeast trend appears to lead into the area. The Brule Creek Moraine (Figure 10.9) represents a subsequent phase in the recession of the Rainy or Patricia lobe, but its for-

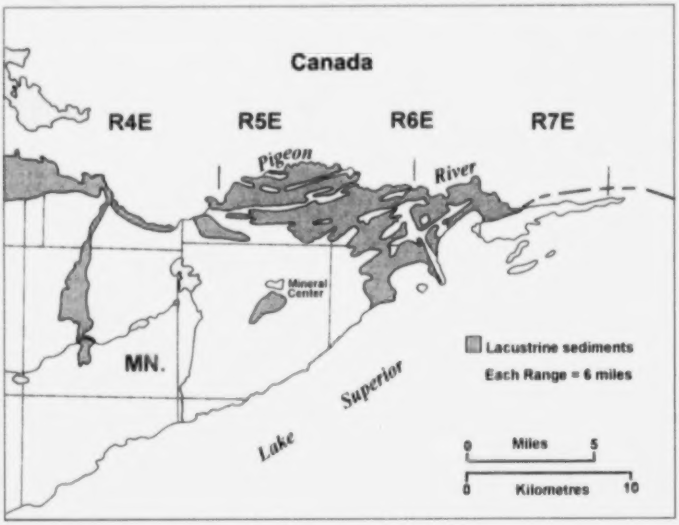


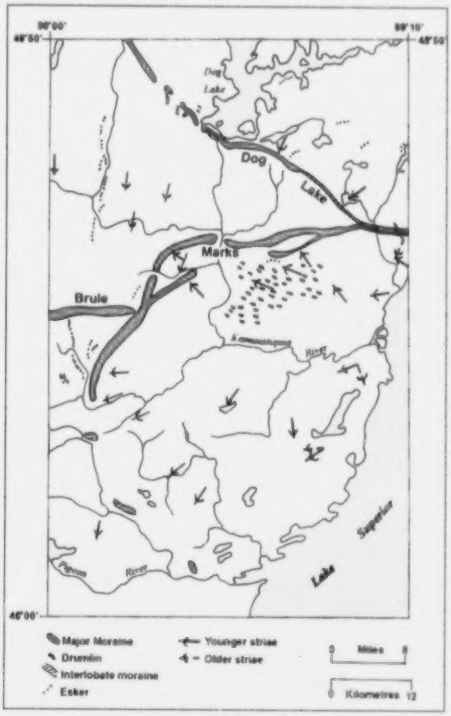
Figure 10.8 Lacustrine Clay Areas in the Borderlands, Some of which Exist at High Eevations. (From Sharp, 1953b, Figure 2).

mer eastward continuation has been destroyed by a later event in the Thunder Bay region – the Marquette Advance.

DOG LAKE AND MARKS MORAINES: The Dog Lake Moraine represents the southern limit of an ice advance from the Lake Nipigon region to the north and east, which is generally referred to as ice of the Hudson Bay lobe (Figure 10.9). The Marks Moraine, which truncates the earlier Brule Creek Moraine, represents the limit of the Superior ice lobe pushing west and north up the Kaministiquia valley from Lake Superior. The two lobes were contemporaneous and met along the west to east trending Mackenzie Interlobate Moraine. As discussed earlier (Farrand and Drexler 1985), both are interpreted as representing the Marquette Advance on the western side of the Superior basin, the ice margin then running southwest towards Duluth either in contact with, or offshore of the Minnesota coast. Whether the Marks Moraine was formed by Marquette ice alone or, is an older feature that was reoccupied by Marquette ice, has been debated (Julig *et al.* 1990; Phillips and Ross 1995). More recent research has noted several locations at which bodies of till and fluvioglacial sediments of northern provenance are incorporated within the usually red-coloured Superior till. Noble (personal communication 1995 to B.A. M. Phillips) proposed the idea of inheritance and modification of the Brule Moraine by the Marquette ice advancing up the Kam valley, and this has now been demonstrated as the likely scenario by Tickle (1996) and by Bajc (2000), both of whom describe sections in the Marks Moraine area that show Superior till overriding an older till of northern provenance.

The southward continuation of the curve of the Marks Moraine is presently known only by isolated morainic features, which were first identified by Zoltai (1963) (Figure 10.9), and also

Figure 10.9 Glacial Features of the Lakehead area. (From Zoltai, 1963, p.104)


Dog Lake
Dog
Lake
Marks
Brule
Kaministiquia River
Pigeon River
Lake Superior
Major Moraine
Drumlin
Interlobate moraine
Esker
Younger striae
Older striae
0 Miles 8
0 Kilometres 12

by several isolated ice contact deltas just east of Whitefish Lake and in Lybster and Fraleigh townships to the south (Timko 1995). The morainic material at the east end of Whitefish Lake has recently been confirmed to be of Superior ice provenance (Williams 1999), but a clear continuation of the Marks ice margin has not been traced through the rugged borderland topography of the Norwesters to the Superior shore, and little is known of the way in which it supposedly turned southwest to parallel the Minnesota north shore. The line is drawn with ease on small scale maps but in reality, the ice margin must have been very irregular in plan shape.

More apparent in the borderlands is the legacy of inundation by a series of subsequent glacial and post-glacial lakes, which have left the region swathed in red lacustrine clays and silts to an elevation of over 427m (1400 feet) in places. The lacustrine sediments form broad flat areas between the steep-sided, mesa-like ridges of diabase, which characterize the Norwester hills between the U.S./Canada border and Thunder Bay.

Proglacial Lakes

GLACIAL LAKE O'CONNOR: The flat-floored valleys of the Stump and Swamp rivers in Cook County, Minnesota, lie north of Hovland, crossed by County Road 16 – the Arrowhead Trail. The water body that occupied these broad valleys was called Lake Omimi by Elftman

(1898:104), and its margins are shown by brown interbedded clay-silt beds that rise to 431m (1415 feet), and by an overlying layer of red clays that rise to 422m (1385 feet). Sharp (1953b) dismissed the conclusion that the lake was an extension of Lake Duluth, because he considered the elevation of 422m (1385 feet) to be too high. The Stump and Swamp valleys are contiguous with the broad valley of the Pigeon River as it flows east from South Fowl Lake (436m; 1430 feet). Tracing the 427m (1400 feet) contour towards the northeast into Ontario (Figure 10.10), reveals that an extensive area on both sides of the border would have been flooded by a lake of this elevation. Sharp (1953b:867) records red clays (over brown clays) close to 427m (1400 feet) in the area of Grand Portage State Park. Red clays have been recorded as draped over the top of ice-contact deltas around the 427m contour as far north as the Whitefish Lake area (Timko 1995). Since the level of Lake Duluth was projected by Farrand to be only 411m (1350 feet) near the Pigeon River border, there is reasonable doubt that this large body of water was at first connected to the 328m (1075 feet) phase of Lake Duluth. Figure 10.10 does not allow for isostatic deformation and does not show that the Superior ice margin must have formed an eastern boundary to the lake. Zoltai (1963:111) named the lake body occupying the Stump, Swamp, Pigeon, and Arrow river basins, 'Glacial Lake O'Conner,' and noted that the only recognizeable outlet was to the south through the Swamp River basin. Although the Swamp River now flows north to the Pigeon River, the southern end of the lake floor (415–421m; 1360–1380 feet) is open to the north shore coastal slopes overlooking Hovland. Water could have poured from Lake O'Conner into a body of water lying against the coastal slopes along the approximate 427m (1400 feet) contour, perhaps the same Epi-Duluth lake level as that which was found in Judge C.R. Magney State Park a few miles to the southwest (Phillips and Hill 1993). Since red clays are draped across much of the topography below 427m (1400 feet) in the Grand Portage area, attaining a considerable thickness of 6m (20 feet) or more in lower areas, it is very likely that continued deposition took place over parts of this large lake basin from a period of early proglacial lakes through the succession of Duluth and Post-Duluth lake stages.

Archaeological Implication

The presence of extensive proglacial lakes in the borderland area has considerable archaeological implications. Most of the present ridge crests and mesa-like summits of this region formed islands in these lakes, and present topography shows that few of these were connected to the 'mainland' until water levels had fallen below approximately 302m (990 feet) – the low Manitou lake level. Even so, the question arises as to why early people would seek to visit these isolated ridge crests. Assuming that early people were following game and moving up the shore into the Thunder Bay area and beyond, the Grand Portage area was, until a much lower water level, a cul-de-sac that lead only to an expanse of open water.

It would appear that, at the time the Swamp and Stump river valleys were filled with water to the 427m (1400 feet) level, and in the period of falling water levels that followed, access to the northeast would most logically have been gained by turning inland in the vicinity of the Brule River (Judge C.R. Magney State Park), and heading north towards Whitefish Lake via

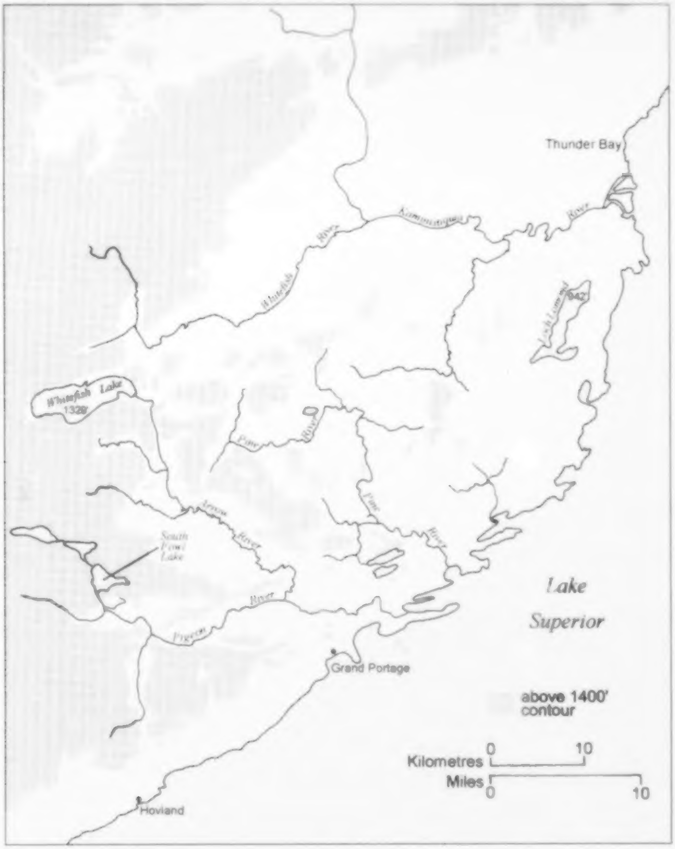

Thunder Bay
Kaministiquia River
Whitefish River
Loch Lomond
942'
Whitefish Lake
1328'
Pine River
Arrow River
South Fowl Lake
Pine River
Pigeon River
Lake Superior
Grand Portage
above 1400' contour
Kilometres 0 10
Miles 0 10
Hovland

Figure 10.10 The Trace of the 1400' Contour in the Borderlands Region. Though isostatic tilt is not taken into account, the figure gives an idea of the area submerged by a shoreline of this elevation. Palaeo-Indian peoples would have been unable to continue up the present shore and would have had to turn north towards the Arrow-Whitefish Lakes area. (From Phillips, 1995)

South Fowl lake, which at 436m (1430 feet) was close to the western shore of the lake body (Figure 10.11). This constitutes a plausible theory of cul-de-sac and bypass that may account for the paucity of Palaeo-Indian sites on the Superior coast between the border and Thunder Bay. Furthermore, it may account for the known Palaeo-Indian sites at South Fowl Lake, as well as those discovered on East Bearskin Lake, Minnesota and around Arrow and Whitefish lakes in Ontario. The former, a site between North and South Fowl lakes, revealed material from Palaeo-Indian through Archaic to historic periods. Much of the material was Archaic, typically copper, but Paleo-Indian material was also found (Platcek 1965). The later material came as a result of the Pigeon River being a key routeway into the interior, but the

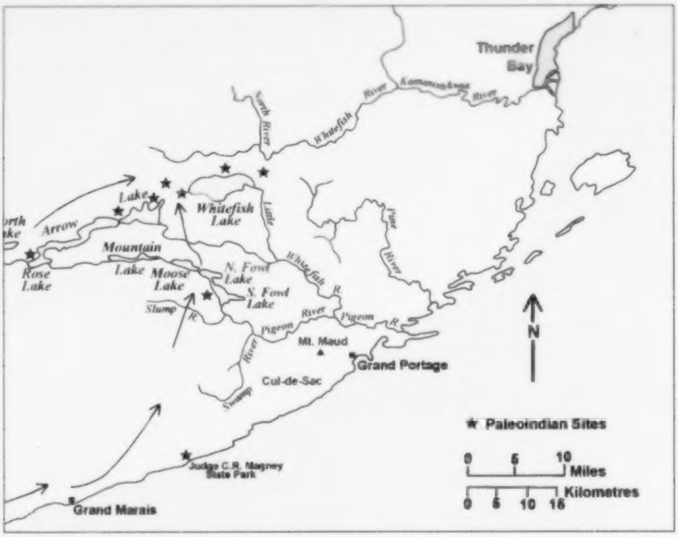

Thunder Bay
River
River
Whitefish
North River
Lake
Arrow
rth
ke
Whitefish Lake
Little
Pine River
Mountain
Lake
Moose Lake
Rose Lake
N. Fowl Lake
S. Fowl Lake
Whitefish R.
Slump R.
River
Pigeon
Pigeon R.
River
Mt. Maud
Grand Portage
Cul-de-Sac
Swamp
N
Paleoindian Sites
0 5 10 Miles
0 5 10 15 Kilometres
Judge C.R. Magney State Park
Grand Marais

Figure 10.11 Cul-De-Sac and Bypass. One proposed migration route for Palaeo-Indian peoples would have been alongshore, turning north from the Brule River. The other would have been an inland route along the grain of the relief and the southern margin of Lake Agassiz. Both converge on the Arrow-Whitefish Lakes area. *(this figure is new to this paper)*

Paleo-Indian material could possibly have been derived from a cross river route, heading towards the Arrow-Whitefish lakes area.

Features of the Arrow-Whitefish Lakes Area

Arrow and Whitefish lakes lie at the eastward end of a chain of lakes extending from Gunflint Lake in Minnesota, through North and Rose lakes – the chain forming a natural linear feature that is roughly followed by the U.S./Canada border. More importantly, it is crossed by a low point of the Arctic divide just southwest of Arrow Lake (Figure 10.12).

Morainic Features

WEST WHITEFISH MORAINE: A kettled moraine has been identified at the western end of Whitefish Lake (Pankuch 1997), which, in its original form spanned the entrance to the Gravel Lakes corridor that runs between Whitefish and Arrow lakes (Figure 10.12). Of distinct northern provenance in its composition, it differs substantially from the morainic material at the eastern end of Whitefish Lake that has already been identified as Superior in provenance and probably related to the Marquette Advance (Willliams 1999). Three observations are worth noting. On the western side of the moraine is a small, lobate deltaic structure that is interpreted as having been constructed by a flow of ice and sediment off the ice margin into

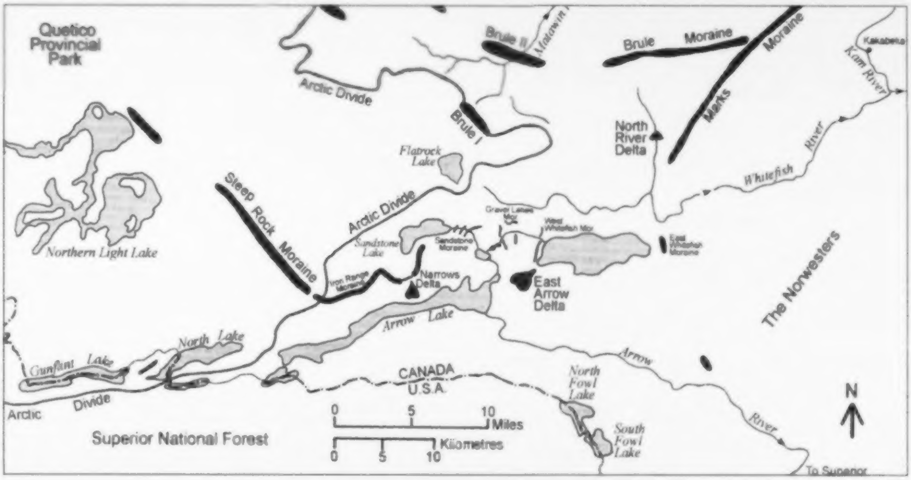

Quetico Provincial Park
Arctic Divide
Brule II
Matawin
Brule Moraine
Marks Moraine
Kakabeka
Kam River
Brule I
North River Delta
Flatrock Lake
Whitefish River
Steep Rock Moraine
Arctic Divide
Gravel Lakes Mor
West Whitefish Mor
Sandstone Lake
Sandstone Moraine
East Whitefish Moraine
Northern Light Lake
Iron Range Moraine
Narrows Delta
East Arrow Delta
The Norwesters
Arrow Lake
North Lake
Gunflint Lake
CANADA
U.S.A.
Arrow River
North Fowl Lake
South Fowl Lake
Arctic Divide
Superior National Forest
0 5 10 Miles
0 5 10 Kilometres
N
To Superior

Figure 10.12 The Geomorphic Features and Archaeological Potential of the Arrow-Whitefish Lakes area. *(this figure is new to this paper)*

a proglacial body of water. Secondly, the central portion of the moraine is missing, which suggests that, at some point after its formation, a substantial flow of water along the Gravel Lakes corridor breached and swept away much of the structure. Thirdly, a Palaeo-Indian site (the Pankuch Site) has been recorded on the lobate delta, adjacent to the southern end of the truncation. The material is scattered along a shoreline just above 457m (1500 feet), a lower level than that into which the delta was formed and probably established after breaching of the moraine.

GRAVEL LAKES MORAINES: The remains of three more morainic features lie within the Gravel Lakes corridor, each in effect spanning the respective east, west and north entrances to the valley (Figure 10.12). The provenance of these features is the same as the West Whitefish Moraine, and their topography suggests that they represent contemporaneous (or nearly so) positions of ice as it vacated the central part of the valley. Several lithic Palaeo-Indian sites have been recorded in the Gravel Lakes corridor, strongly accordant in level with proglacial or postglacial lakes at the levels of 472m (1550 feet) and 457m (1500 feet)(McLeod and Phillips, unpublished field notes).

SANDSTONE CREEK MORAINES: A series of similar morainic features are found partially spanning the Sandstone Creek at the western end of the Gravel Lakes corridor (Figure 10.12), and moraines composed of northern but heavily local material can be traced to the west along the grain of the topography.

IRON RANGE MORAINE: Probably continuous with the Sandstone moraines, the Iron Range Moraine can be followed to the west, along the north side of the ridge that separates Sandstone Lake from Arrow Lake (Figure 10.12). In the rock-walled valley of Dodds Pond, the feature is represented by a kettled and deformed apex of an ice-contact delta, the Narrows Delta. Further west, the moraine extends along the south side of Iron Range Lake, sometimes as a separate ridge but in places plastered against the rising ground to the south. Near Prelate Lake, the feature appears to merge with the position of the northwest-southeast trending Steep Rock Moraine.

The scenario is akin to valley deglaciation. The landscape of high, rock-walled mesa-like rock masses separated by deep valleys, encouraged ice to remain longest in the valleys around and between the upland masses, gradually melting back to exhume the lower topography. These minor, cross-valley moraines were formed as ice stagnated or even locally readvanced during the general recession, small localized proglacial lakes forming between them. In terms of deglaciation chronology, it is likely that these recently mapped morainic features represent stages of the decay of the Rainy (or Patricia) ice lobe as it melted back from the Steep Rock Moraine towards the position of the Brule Moraine, during the Gribben interstadial. The Marquette Readvance later emplaced the Marks Moraine close to the eastern end of Whitefish Lake. Thus, the study area is complicated by the potential overlap of features of Marquette age with those of the earlier period.

Proglacial Lakes

GLACIAL LAKE ARROW: At the eastern end of Arrow Lake there lies a large deltaic structure (Figure 10.12). About 1 square mile (2.6 square km) in area, the feature is built out from the bedrock saddle separating Whitefish from Arrow Lake. It lacks any present day source of water and sediment, is backed by a precipitous slope into Whitefish Lake, and lies at an elevation over 503m (1650 feet) at its apex, 42m (138 feet) above the present level of Arrow Lake. The feature was formed in contact with ice filling the Whitefish basin and is composed of a huge quantity of fluvioglacial sediment that spilled over the bedrock saddle into a body of water in the Arrow basin that was at least 503m (1650 feet) in elevation (Pankuch 1997). Distributary channels incise the delta surface, revealing a subsequent history of water level decline after initial formation, and a complex of lower braided channels and shoreline features exist between the delta front and the present shore of Arrow Lake (460m; 1510 feet).

Similarly, the Narrows Delta, a smaller feature in area, built up into this 503m (1650 feet) body of water in its early stages, and lower terraces and distributary channels later developed across its surface. The water and sediment source for this feature would have been from ice lying along the position of the Iron Range Moraine and later, from a proglacial lake occupying the Sandstone Lake basin when ice had retreated further north, possibly north of the Arctic Divide (Figure 10.12).

Immediately striking is the requirement that an ice marginal water body existed within the Arrow Lake basin at a present elevation of 503m (1650 feet), much higher than evidence of any other early lakes. The delta is composed primarily of varieties of igneous and metamorphic rocks from the area to the north and west (Pankuch 1997), suggesting that it was formed when ice occupied the position of the West Whitefish Moraine.

The presence of the East Arrow Delta raises the question of which glacial lake occupied the Arrow basin at the time of formation and of what geographic extent was this lake. In the process of investigating this, Phillips (1997) determined that a lake lying along the current

503m (1650 feet) contour would extend westward along the Gunflint-Arrow lakes chain, cross the Arctic divide and continue into northern Cook County without topographic interruption, forming a southwest-northeast trending body of water lying against the northern slope of the high ground of the Boundary Waters Canoe Wilderness Area (BWCWA). In order to take into account the degree of isostatic deformation that has taken place since the presence of this extensive proglacial lake, a retrodeformation analysis was undertaken, using an available digital elevation matrix and appropriate GIS software. From diagrams of uplift and displacement of Lake Agassiz shorelines (Teller *et al.* 1996) it was determined that, should the Upper Herman stage of Lake Agassiz (ca. 11,200 B.P.) be hypothesized as extending further east than currently conceived, this lake stage, initially of 323m (1060 feet) at the southern (Minnesota River) outlet, would have been deformed to an elevation of 501m (1644 feet) if traced as far east as Arrow Lake (178m or 584 feet of uplift). By first constructing a deformation surface and then subtracting it from the present DEM of the Arctic basin portion of Minnesota, Phillips (1997) reproduced the topography of the area in Upper Herman times. flooding this topography to the 1060 fasl (323m) level reconstructed the Upper Herman stage of Lake Agassiz. On the model this is seen to extend eastwards along the northern flank of the high ground of east central Minnesota and across the U.S./Canada border into the Gunflint-Arrow lake chain, where it crosses the Arctic watershed into Arrow Lake (Figure 10.13). The East Arrow Delta could have been formed in a water body of 1650 fasl (503m) which was a part of Lake Agassiz. Wasting ice would have lain immediately to the north,

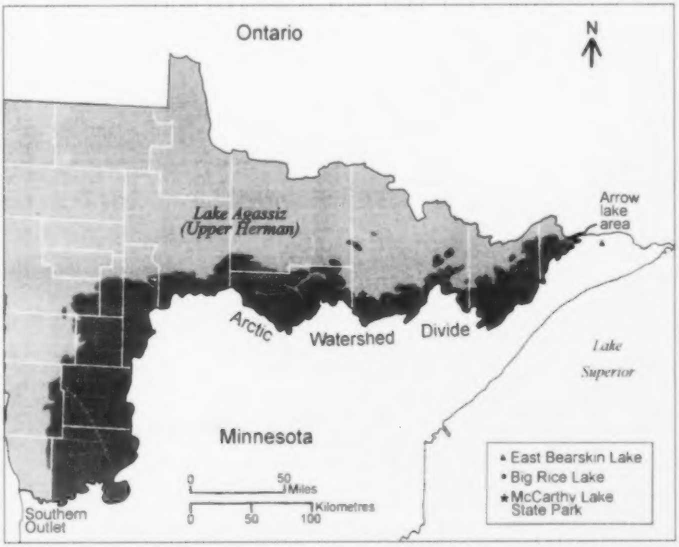


Figure 10.13 Paleogeography of the Upper Herman Stage of Lake Agassiz by Retrodeformation, and the Potential Extension of this Lake Stage into the Gunflint-Arrow region. Showing three related archaeological sites. (After Phillips, 1997)

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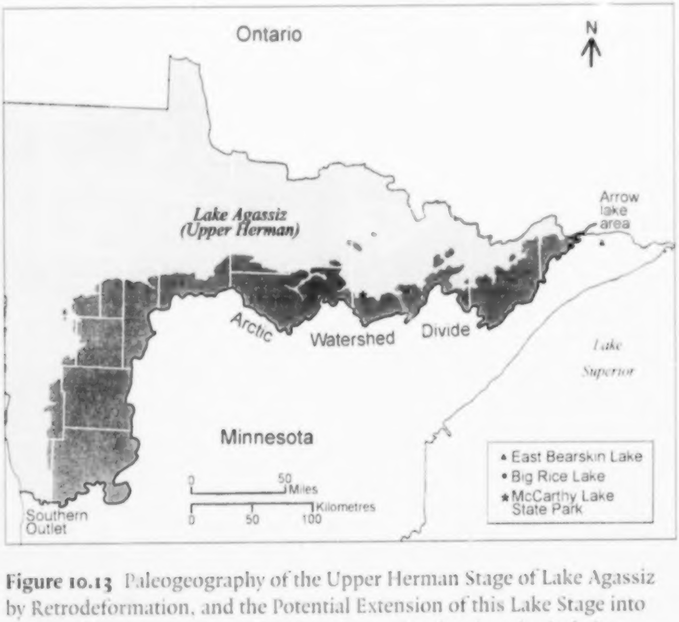

Figure 10.13 Paleogeography of the Upper Herman Stage of Lake Agassiz by Retrodeformation, and the Potential Extension of this Lake Stage into the Gunflint-Arrow region. Showing three related archaeological sites. (After Phillips, 1997)

forming the north shore of the narrowing outlet. The water would have flowed from the Arrow Lake basin into Early Lake Minong in the Superior basin, via what is now the misfit Arrow River valley.

In summary, evidence does suggest the possibility for Arrow Lake potentially acting as an early eastern outlet for Lake Agassiz, before, and at the time that ice lay against the Steep Rock Moraine. In doing so, a natural route was provided for Palaeo-Indians moving eastwards through northern Minnesota along, or parallel to, the southern shore of Lake Agassiz. Only when ice withdrew towards the position of the Brule Moraine would an Agassiz flow have used the flatrock outlet, and this would have followed the construction of the West Whitefish Moraine and those of the Gravel Lakes and Sandstone areas.

Lakes of Lower Level

Reference has already been made to lower lakes associated with the moraines of the Arrow-Whitefish area, particularly one at the 472m (1550 feet) level. The fact that the East Arrow Delta is incised by a discharge channel that built a small elongated delta into a water level of about 488m (1600 feet), suggests that some water was still flowing from the Whitefish Lake basin after water levels had begun to fall in the Arrow Lake basin. No features of the 488m (1600 feet) are found in the Whitefish Lake basin east of the West Whitefish Moraine. A continuous series of raised beach and minor bluff features extends from 488m (1600 feet) to the present water level of Arrow Lake (460m; 1510 feet), one of the more marked ones being a 472m (1550 feet) bluff. This can be traced into and through the Gravel Lakes corridor to the Whitefish Lake basin. An interpretation of this paleogeography is that, as ice melted back from the West Whitefish Moraine, water between the ice and the moraine continued to spill over the saddle to incise a channel into the now emerged East Arrow Delta. However, pressure on the moraine was such that breaching followed and water levels in the Whitefish basin fell to the 472m (1550 feet) level of the Arrow Lake basin, before continuing to decline to its present level of 405m (1329 feet). The Tower Road site (DbJm-6) on the slopes above the north side of Whitefish Lake lies on the 472m (1550 feet) contour, of similar elevation to several sites within the Gravel Lakes corridor. Traced east and north, the 472m (1550 feet) level is found to be the apex of the North River Delta (Figure 10.12), a kettled delta formed by meltwater spilling southwards from the position of the Brule Moraine. Bajc (2000) reports an ice contact delta built off the Brule Moraine that grades to a water level of 457–472m (1500–1548 feet), which he correlates with a lower Herman stage of Lake Agassiz. An interpretation of this paleogeography is that lake levels of 472m (1550 feet) and lower, accord to the period at which ice had melted back from the Whitefish-Gravel Lakes area to the position of the Brule Moraine. The sustained influence of Lake Agassiz, of a lower Herman level, is shown by the clay sequences in the Whitefish River valley where red clays of a western (Agassiz) source, overlie dark clays of a more local northern and eastern source (Culbert 1999). Although the chronology and relationship to Lake O'Connor and other proglacial lakes of the region is as yet, not wholly clear, both Culbert (1999) and Bajc (2000) agree that the Whitefish valley clay sequence was later over-ridden by Marquette ice.

Within the Whitefish Lake basin and the area to the east of it, a marked shoreline feature occurs at the a 442m (1450 feet) level. Evidence of this was reported by Timko (1995), who associated the feature with the wasting of Marquette ice from the morainic position found at the east end of Whitefish Lake. Since Janhke (1993) traced a 442m (1450 feet) and a 427m (1400 feet) shoreline along the southern flank of the Marks Moraine towards Whitefish Lake, the association is logical, his proglacial 'Lake Cedar Creek' (named after a local stream and resulting from the melt back of the Superior lobe from the Marks Moraine) being contiguous with Timko's 'Lake Strange' (named after Strange Township).

Demonstrated here is the complexity resulting from the occupation of the Whitefish Lake basin by two successive ice marginal events, separated by at least 1000 years, and the overlap of their respective features. Current interpretation places these lower lake levels as that of Marquette age and later. Bajc (2000) notes that similar silty clays lie both below and above the Marquette till in some Whitefish valley sections, suggesting that Superior ice re-established a proglacial lake similar to Lake O'Connor, at least in part, and sedimentation continued during and after Marquette ice began melting back.

Archaeological Implication

Holliday (2000) has recently reviewed Palaeo-Indian 14^{C} chronology and concludes that the Clovis projectile point tradition was from 11,200 to 10,700 B.P. (13,500 to 12,800 calendar yrs. B.P.), the Folsom (fluted point) tradition from 10,900 to 10,000 B.P. (12,800 to 11,800 calendar yrs. B.P.), and the unfluted point traditions, generically referred to as the Plano tradition (Plainview-Agate Basin-Hell Gap-Cody-Scottsbluff-Eden sequence) from 10,000 to 9000 B.P. (11,200 to 9,800 calendar yrs. B.P.) Some caution is needed in applying such dates rigidly, since there is a diachronic component with location. Anderton *et al.* (this volume) conclude that the Agate Basin tradition approximates with the Gribben interstadial and that the Hell Gap tradition was contemporaneous with the Marquette advance. They correlate the Great Lakes Cody tradition with Lake Minong (9,500 B.P.) and post-Minong time. McLeod (2000) notes that most lithic points found in the Thunder Bay area are of lanceolate shape and are difficult to assign to a single type. He further comments that this variation, apparently typical of the Lakehead Complex and the Plano tradition for Northwestern Ontario, makes it difficult to use projectile points for relative dating of sites.

If the Gunflint-Arrow Lakes corridor was used as an early eastern outlet of Lake Agassiz, at the Upper Herman stage, the south shore of Lake Agassiz would have provided a logical route for Palaeo-Indian people, as they perhaps used the recently vacated moraines as routeways and followed game eastwards from the Red River-Minnesota River southern outlet along the northern flank of the Minnesota highlands. Ironically, the northern parts of the counties of St. Louis, Lake and Cook, where the Upper Herman shoreline lay, are remote, and very little research has been conducted in the area.

One interesting find is that of Palaeo-Indian material in 1999 in McCarthy Beach State Park, St. Louis County, Minnesota (Radford, D., personal communication to B.A.M. Phillips) (Figure 10.13). The northwest-southeast axis of the park follows an end moraine and on the northeast flank, at a present elevation of 425m (1394 feet), lies the Upper Herman shoreline (323m (1060 feet). The site lies between two small lakes below the southwest facing flank of the moraine. It is interesting to note that the site lies on a nearby small lake of southern aspect, rather than on the north facing slope of the shore of Lake Agassiz. Two lanceolate points were found and a report is pending.

Another perhaps more significant find was reported by Mulholland (2000). North of Virginia, St. Louis Co., Minnesota, on the Big Rice Moraine (Figure 10.13) a jasper-taconite point, fluted on both sides, was found. This Folsom tradition point denotes a Palaeo-Indian presence in the pre-Marquette period. Along the south side of Big Rice Lake (437m; 1435 feet), the Big Rice Moraine forms a west to east watershed divide, which rises to about 472m (1550 feet). Referring to the retrodeformed model of elevation in the Upper Herman lake stage of Lake Agassiz, it is seen that a narrow, sheltered reentrant of the lake approached within a very short distance of the northwest corner of Big Rice Lake. The 323m (1060 feet) lake level is equivalent in the model to the present 436m (1430 feet) contour and may well have extended into the Big Rice basin to the foot of the Big Rice Moraine. Again, the compelling suggestion is that Palaeo-Indian people were present on the southern shore of the Upper Herman stage of Lake Agassiz and may well have travelled eastwards along the shore, into the Gunflint- Arrow-Whitefish area.

Further east, there are no identified sites until the Gunflint-Arrow-Whitefish lakes corridor is reached. Here, following the bypass/cul-de-sac theory presented earlier, the inland Agassiz shore route met with the coastal route and diverted inland. A recent excavation was conducted by Peters (1990) at East Bearskin Lake, just south of the Gunflint-Arrow lakes corridor in Cook County, Minnesota (Figure 10.13). The points that were found were termed 'Holocombe,' a point style that falls into the period of transition from Folsom to Plano, post-dating 10,400 B.P. This is currently the oldest site close to the Gunflint-Arrow-Whitefish lakes corridor.

The Marquette Readvance maximum, dated by Lowell *et al.* (1999) at 10,025 ± 100 14^{C} yrs. B.P. accords with a calendar date of about 11,000 B.P. (based on Lowell and Teller 1994, and Taylor *et al.* 1996). The retreat of Rainy (Patricia) ice from the area to a position just east of Lake Nipigon took place just before the Younger Dryas cooling event, dated 11,000 to 10,000 B.P. (Lowell *et al.* 1999) when readvance occurred. Thus, the age of the sites of the Arrow-Whitefish area fall in a window between the Upper Herman stage of Lake Agassiz, when the lake is believed to have used an eastern outlet through the Arrow Lake corridor, and the period following the Marquette readvance, when Palaeo-Indian people occupied the Beaver Bay and Minong levels of Lake Superior in the Kaministiquia valley.

McLeod (2000) suggests that the earliest arrivals in the Thunder Bay area were people who used Agate Basin and Hell Gap artifacts. They entered about the time of the Marquette readvance, possibly forced eastward by the rising waters of Lake Agassiz, which resulted from the closure of the eastern Lake Nipigon outlets. McLeod interprets the sites of the Arrow-Whitefish area as associated with proglacial lakes that resulted from Marquette ice damming, and notes that these people camped within 2 km (1.25 mi) of the glacial front. McLeod (1981) suggests that these people stayed in the area, adapting to the developing Boreal Forest environment. As Marquette ice retreated, these people moved east into the Kaministiquia valley, down to the Beaver Bay and Minong lakeshores of Lake Superior, where evidence of their presence is more abundant (Phillips 1988; Stuart 1993; Phillips and Ross 1995; Hamilton 1996).

Discussion

Based on the fact that there is no artifactual evidence to suggest otherwise, it is archaeologically appropriate to associate the Palaeo-Indian sites of the Arrow-Whitefish area with the period of the Marquette Advance and beyond (McLeod 2001). However, earlier in this paper, the interpretation of the moraine and glacial lake sequence led to the conclusion that the West Whitefish Moraine is of Rainy lobe and not Superior lobe provenance (Pankuch 1997). Furthermore, the 472m (1550 feet) shoreline, along which a number of sites lie, is associated with deltas that result from the melt back of ice to the Brule Moraine, not with the Marks Moraine (Marquette). In addition, the 503m (1650 feet) East Arrow Delta and the evidence from the retrodeformation model, implies the possibility that the Upper Herman stage of Lake Agassiz used the Gunflint-Arrow lakes corridor as an early eastern outlet, around 11,200 14^{C} yrs. B.P., potentially forcing the movement of Palaeo-Indian people into the area. On paleogeographic evidence alone, there is the very real possibility that current evidence of Palaeo-Indian presence in the Arrow-Whitefish corridor could be extended back to the time when Rainy (Patricia) lobe ice lay at, or about the Brule Moraine. This is about 1000 years before the Marquette Readvance and very possibly prior to 11,000 B.P.

Ongoing fieldwork by McLeod and Phillips, Ross, Hamilton and others will hopefully clarify the palaeohistory of the Minnesota-Ontario borderlands in due course, particularly if points of a distinct pre-Plano tradition are found in the Gunflint-Arrow-Whitefish corridor.

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11.

Prehistoric Drainage and Archaeological Implications Across the Submerged Niagara Escarpment North of Tobermory, Ontario

S.E. Janusas, S.M. Blasco, Stan McClellan and Jessica Lusted

Abstract

Post Main Algonquin low level lake stands drained the intermittently subaerially exposed Niagara Escarpment between Tobermory and Manitoulin Island between 10,000 and 5,000 years ago. Lakebed surveys of the submerged escarpment, conducted since 1993 using sidescan sonar, an echo sounder, a manned submersible, and SCUBA divers has led to the identification of four prehistoric river channels that drained the upper Great Lakes into Georgian Bay. River flow bifurcated north of Cove Island, flowed northward over a large spillway east of Lucas Island, and flowed south and eastward over a similar large spillway south of Middle Island. Another channel flowed north of Fitzwilliam Island. The two former spillways with heights similar to present-day Niagara Falls flowed as giant rapids, discharging waters into the drained Georgian Bay Lake basin. Radiocarbon dating of newly discovered in-situ submerged tree stumps constrains the period of operation of the waterways from 9,360 to 7,230 B.P. Mapping the location of prehistoric waterways may yield potential archaeological sites for investigation of the Paleo-Indian and Archaic aboriginal culture periods and test site potential modeling in an inundated environment.

Résumé

Les divers bas niveaux qui ont suivi le grand lac Algonquin ont drainé l'escarpement de Niagara exposé de façon intermittente entre Tobermory et l'île Manitoulin entre il y a 10 000 et 5 000 ans. Les reconnaissances effectuées en 1993 dans le lit de l'escarpement submergé à l'aide d'un sonar, échosondeur, d'un submersible habité, et de plongeurs sous-marins ont conduit à l'identification de quatre chenaux fluviaux préhistoriques qui ont drainé les hauts

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Grands Lacs et la baie Georgienne. Les chenaux fluviaux se sont divisés au nord de l'île Cove, entraînant les eaux vers le nord grâce à un grand déversoir situé à l'est de l'île Lucas ainsi que vers le sud et vers l'est grâce à un autre déversoir, aussi important que le premier, situé au sud de l'île Middle. Un autre chenail se trouvait au nord de l'île Fitzwilliam. Les deux premiers déversoirs, dont la hauteur égalait celle des chutes Niagara, formaient d'énormes rapides dont les eaux s'écoulaient dans le basin drainé du lac de la baie Georgienne. Les datations par le radiocarbone de souches submergées et récemment découvertes in situ place la période d'écoulement des cours d'eau entre 9 360 et 7 230 A.A. Déterminer l'emplacement des cours d'eau préhistoriques est susceptible d'aider à déceler des sites archéologiques potentiels qui mèneront à l'étude des cultures aborigènes archaïques et paléoindiennes, et pourront mettre à l'épreuve les modèles de prévision des sites dans un environnement inondé.

Introduction

The Ontario Marine Heritage Committee (OMHC) is an organization comprised of both professional and avocational archaeologists and marine historians. In 1993 OMHC initiated a project to locate inundated prehistoric shorelines in Georgian Bay with the expectation that delineation of these shorelines would assist in the location of inundated prehistoric archaeological sites and provide an understanding of inundated paleo-habitats (Figure 11.1).

The following year, the OMHC formed a partnership with the Geological Survey of Canada whose scientists were pursuing similar goals. The Geological Survey of Canada project focus was to determine prehistoric channel flow and sedimentation processes.

The next year a tripartite partnership was formed between the OMHC, the GSC and Parks Canada. Parks Canada's interest in the project was mainly stimulated by the science that was being conducted within their National Marine Park boundaries.

Background

The geology of the submerged Niagara Escarpment is particularly valuable to archaeology for, without the information contributed by an understanding of submerged paleoenvironments, it would be impossible to forecast any paleohabitat potential zones or to locate specific archaeological sites. The project has a relatively short field season based on a largely volunteer base, limited dive conditions, and limited funding.

Similar research is being conducted on the west coast of Canada by Josenhans *et al.* (1997). The project entails mapping paleoenvironments and attempting to locate early human remains. The difference between this research and the current research being described in this paper is that the west coast study hopes to make inferences regarding the early migration of humans into the New World. Research in Georgian Bay does not extend into the area of human migration with regard to how humans entered into North America. However, the delineation of Georgian Bay prehistoric shorelines does lend itself admirably to the mapping of paleoenvironments during the period of time considered suitable for human occupation. Various researchers (Lewis *et al.* 1994; Ellis *et al.* 1990) have hypothesized that during the period of low lake levels, prehistoric humans extended their territory to include currently inundated lands.

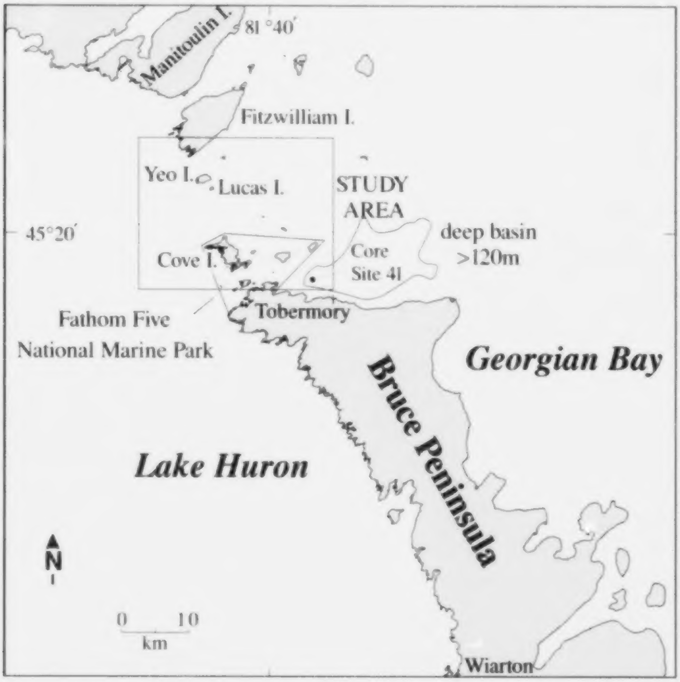
Manitoulin I.
81°40′
Fitzwilliam I.
Yeo I.
Lucas I.
STUDY AREA
45°20′
deep basin >120m
Cove I.
Core Site 41
Fathom Five National Marine Park
Tobermory
Georgian Bay
Bruce Peninsula
Lake Huron
N
0 10
km
Wiarton

Figure 11.1 Map of the Study Area.

As with any other project, one must crawl before one can walk, and then one must walk before one can run. Georgian Bay is a large body of water, which has been charted not by scientists, but by cartographers intent on identifying water depths and obstacles to the safe operation of watercraft. Therefore, the data that existed prior to the beginning of this research was inadequate for isolating areas that might indicate inundated paleorivers. The chart data indicated in a broad sweep, water depths and obstacles. An echo sounder was used to complement the chart data. By conducting traverses back and forth across a given area, water depths were recalculated to include a much more definitive cross-section of the bottom. Initially, it was this method that provided clues to the existence of paleo-drainage channels. This research was later augmented by two other methodologies. The first of these was the use of sidescan sonar, which bounced back information defining objects that were not flat on the bottom. Using this information in combination with the echo sounder, gaps in chart information were filled to such a degree that channel/river profiles could be delineated. The second methodology employed ground truthing, which was conducted in three different ways. The first method used SCUBA divers to verify the information gathered. A second method employed (when it was available) the use of a Department of Defense SDL-1 submersible. Geologists and archaeologists explored depths without risk of decompression sickness and could move about with some degree of flexibility. The third observation method included the use of a remotely operated vehicle (ROV) with a video camera attachment. Feedback of the video to the support vessel was almost instantaneous, providing on-board scientists with the means to direct the ROV with the most optimum positioning.

The fieldwork since 1993 has resulted in the discovery of four distinct prehistoric channels or paleorivers (Figure 11.2). The first of these channels is known as the Fitzwilliam Channel, and runs from west to east south of Manitoulin Island and north of Fitzwilliam Island. This gorge is over a kilometre (0.5 nautical miles) long, approximately 100m (330 feet) wide and 11.5m (37.7 ft) deep at a water plane of 30m (98.5 ft). The sill depth of this gorge is 41.5m (136 ft) (Blasco *et al.* 1998:15).

The Fitzwilliam outlet played an important role in the drainage of the Great Lakes following the deglaciation of the area. Water running through the gorge would have been moving at incredible speeds when fully charged. The paleogorge itself would have presented difficulties for prehistoric humans in terms of use for crossing, fishing, caribou hunting, and so on; however, because of the natural grandeur of the area, it would have been an attraction for prehistoric humans, possibly as a sacred place. However, if offerings were made at this location and tossed into the gorge, it is doubtful that any evidence of these offerings would remain, given the current strength, the narrow gorge, and the rocky nature of the sides of the gorge. It is possible though, that the inundated water plane could have been used as part of a sacred place or for short-term campsites. The relatively flat nature of the top of the inundated gorge would lend itself very well to activities of this sort.

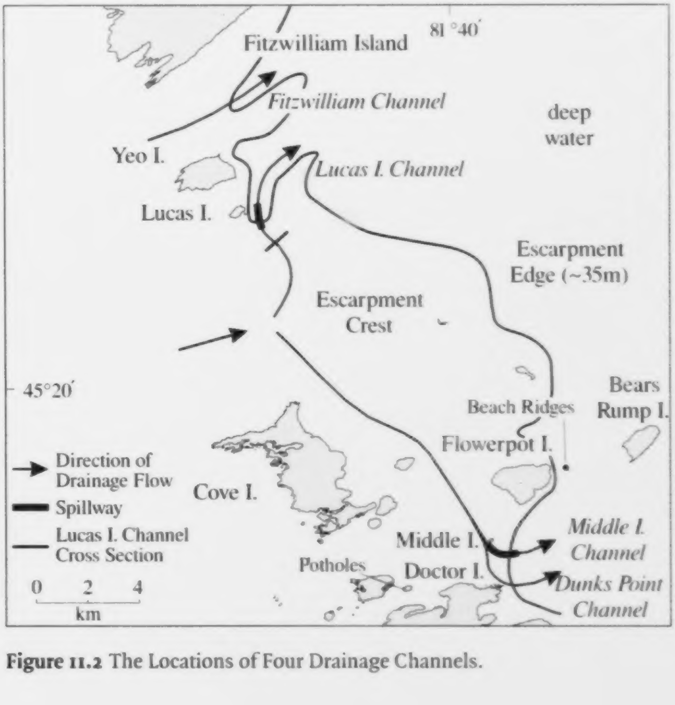
Fitzwilliam Island
81°40′
Fitzwilliam Channel
deep water
Yeo I.
Lucas I. Channel
Lucas I.
Escarpment Edge (~35m)
Escarpment Crest
45°20′
Bears Rump I.
Beach Ridges
Flowerpot I.
Direction of Drainage Flow
Spillway
Lucas I. Channel Cross Section
Cove I.
Middle I.
Middle I. Channel
Potholes
Doctor I.
Dunks Point Channel
0 2 4
km

Figure 11.2 The Locations of Four Drainage Channels.

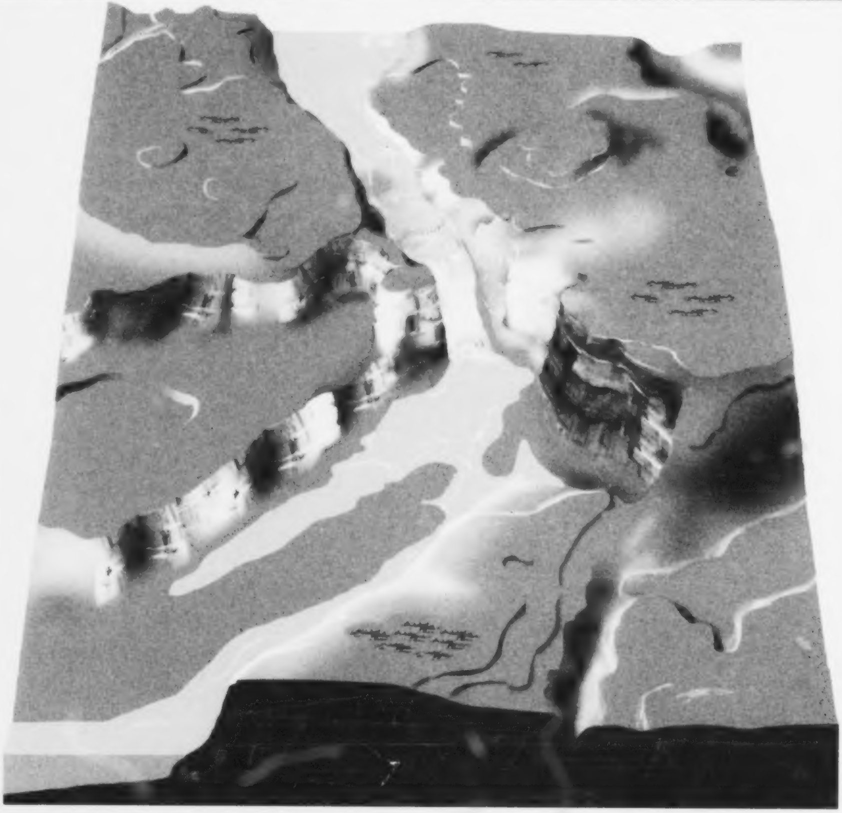

Figure 11.3 The Lucas Island Channel.

The Lucas Island channel extends south from the Fitzwilliam channel and passes to the east of Lucas Island (Figure 11.3). Morphology of Lucas Island consists of a channel 3.5 km long, 0.2 to 1 km wide and 1 to 20 m deep along its axis (Blasco *et al.* 1997:220). Minimum depth taken along the axis of the Lucas Island channel thalwag (the deepest part of the channel running parallel to the channel) is 33.5m. Examination of the channel itself shows a configuration that consists largely of exposed bedrock, occasional boulders, patches of unconsolidated recent sediment and very little else. Current speeds through this channel and the other channels as well, would have been at peak, in excess of 5 to 6 miles per hour. This level of current strength would have effectively scoured the channel of any possible prehistoric materials that may have entered the paleorivers. However, when current speeds were diminished, resulting from a diminished deglaciation water flow, this paleoriver and those of the Middle Island and Dunk Island paleorivers, would have been prime locations for many

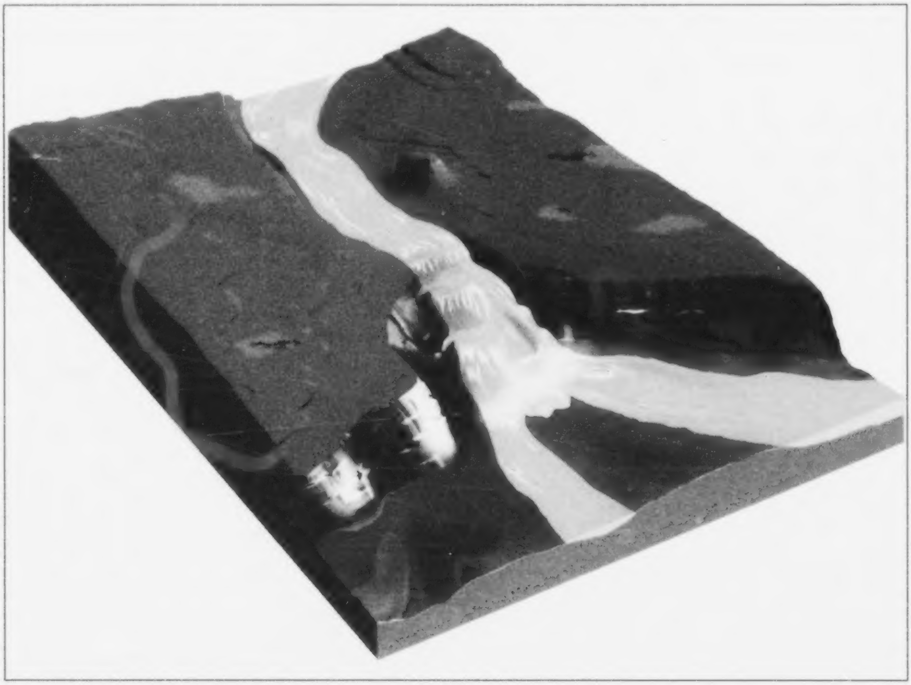

Figure 11.4 The Middle Island Channel.

prehistoric activities. Undoubtedly, there would also have been as yet unidentified, narrowings of the channel and stretches of quieter water where caribou might have utilized these gentler waters for crossings.

The Middle Island channel is located to the south and east of Lucas Island (Figure 11.4). This channel is characterized by a less well-defined cross-section. Sill depth at Middle Island is 30.8 m. The channel length is not well-defined but channel width is 800 metres and the depth is less than 6 metres along its axis (Blasco *et al.* 1997). Current strength is very strong in the Middle Island channel as well, and in this instance, is indicated by large relict sand waves (Blasco 2000:11).

Drainage also flows southeasterly along the Middle Island channel, turning eastward south of Middle Island, down the escarpment face, and again northeast to the French River and the Mattawa-Ottawa valleys (Blasco *et al.* 1997).

The Middle Island and Lucas Island channels share a characteristic morphology of a steep incline rather than a waterfall (vertical incline). The archaeological significance of this channel is its geomorphology; for the channel bifurcates, providing a paleoenvironment that may have been attractive to aboriginal peoples. The configuration of the channel is depicted in a conceptual drawing of the view from above with the horizon looking northwest (Figure 11.4).

The fourth, Dunks Point channel, runs to the south and parallel to the Middle Island channel. Exact dimensions of this channel have not yet been determined.

The low lake levels of Lake Stanley and Lake Hough have resulted in intermittent exposure of the currently submerged escarpment crest located north of Tobermory over a period of 3,200 years, from approximately 10,200 B.P. to 7,000 B.P. (Lewis *et al.* 1994).

The geological significance of the identification of these prehistoric channels lies in the determination of the direction of the flow of water during the early Holocene period. These four channels provided the main routes for water that flowed through the French River. During this same period, the flow over Niagara Falls amounted to a mere trickle.

The archaeological significance of the identification of these prehistoric channels is the delineation of prehistoric drainage patterns. Potential modelling has been used for well over a decade in many municipalities in Ontario (Janusas 1984). The extension of an archaeological model for a submerged environment employs the same basic modelling criteria. For example, the presence of nearby drainage indicates a high potential for the recovery of archaeological remains, with some additional qualifying criteria.

One of the first difficulties in building a potential model for inundated environments is calculating for isostatic rebound. The entire study area has not yet been corrected for isostatic rebound, which is a very arduous process. The second difficulty is the limited area of observation. While the four drainage channels have been defined, the surrounding environment on either side of the channels requires more mapping of the bottom topography. The third difficulty stems, at least in the case of the study area, from the lack of retained sediment. That is, there is limited soil or sediment coverage in the area. Rather the bottom topography is exposed bedrock. This limits potential modeling in two ways. Firstly, visual perceptions of the area often assist archaeologists when viewing a landscape for archaeological potential, and secondly, vegetation is also non-existent to aid in this visual perception. The fourth difficulty arises from acquiring a meaningful understanding of inundation processes.

Inundation processes are especially significant in Georgian Bay, where it has been determined from the geology that there were three periods of rising and falling water levels. The lake level curve (Figure 11.5) is defined by sill and outlet elevation histories (Lewis *et al.* 1994), and some controversy suggests that lake levels dropped lower in the Huron basin at 8,000 B.P. Evidence indicates that Lake Hough was at least 20 metres lower than Lake Stanley. This is indicated by the sedimentary furrows that were eroded into glaciolacustrine clays by strong channel currents that flowed in 71 metres of water at the base of the Lucas Island channel. In addition, relict ice scoured the lakebed in 100 m of water east of Middle Island and also, beach ridges in 48 to 53 metres of water east of flowerpot Island. Furthermore, the relict channels of the Middle Island and Dunks Point spillways existed in a 60-metre water depth on the escarpment face (Blasco 2000). The water depth of these features tends to confirm the low water curve plotted by Lewis.

A summary of the geological data indicates that over a 3,000-year period, from between 10,200 and 7,200 B.P., there were at least three low stand lake levels in the Huron and Georgian Bay lake basin resulting in drainage across the exposed escarpment. As water levels dropped during each cycle, initial sheetflow across the entire escarpment gave way to flow along four discharge channels. As the water levels continued to drop, even these channels dried up, exposing the entire escarpment for short intervals of time (Blasco *et al.* 1997).

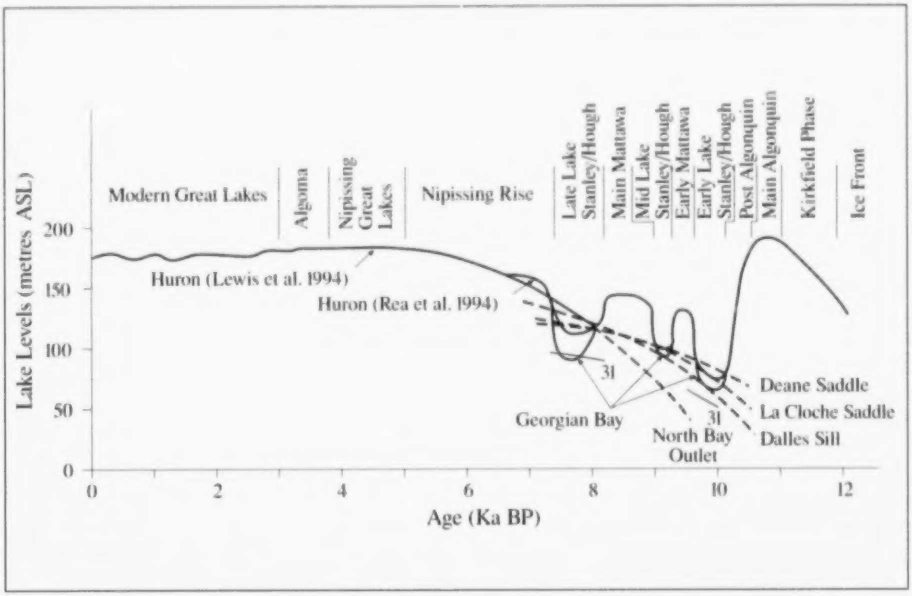

Figure 11.5 Lake Level Curve Based on Elevation History.

The archaeological significance of these periods of exposure is clear. During periods of low stand lake levels and, dependent on the length of these periods, the areas have the potential to be utilized by aboriginals either for settlement or, for the exploitation of available resources. The correlated data from the geological evidence and radiocarbon dates provided by in situ submerged trees defines three time periods. These time periods existed from 10,200 to 9,600 B.P. (600 years), 9,200 to 8,900 B.P. (300 years) and from 8,100 to 7,200 B.P. (900 years).

During this project, evidence has supported the existence of vegetation during these open land periods. In situ trees have been located in depths ranging from 3 to 43 metres and have a 14C-date range between 9,360 ± 80 B.P. to 7,230 ± 90 B.P. Dr. Doug Larsen has identified the majority of these trees as Eastern White Cedar *(Thuja occidentalis)*, Eastern Hemlock *(Tsuja canadensis)*, and Tamarack or Larch *(Larix larcina)*.

Vegetation can be used as an indicator of topography and subsequently, as a variable in prehistoric site location. Therefore, vegetation association becomes an important variable in the determination of site location probability.

Eastern white cedar is most often associated with swampy areas, growing on limestone bedrock or in shallow, dry soils over limestone bedrock. Eastern white cedar is associated with swampy areas, often co-existing with other tree species such as black spruce and tamarack. The white cedar can be found in pure stands or in mixed stands, where eastern hemlock might also be located (Hosie 1975).

There are always exceptions to most rules, as is the case with the above-noted vegetation association. The typical forest/topographic association is not the norm for the upper Bruce Peninsula. In this area, eastern white cedar is often located in highly elevated, well-drained locations.

Nonetheless, the vegetation association data coupled with the depths of the in situ submerged trees leads to the inference that prehistoric aboriginal activities could have occurred at current water depths of over 43 metres. Geological data (the three low water stages of Georgian Bay), biological data (presence of in situ vegetation), and 14C dating data strongly support the theory that the prehistoric cultural periods of the Late Paleo-Indian and the Early to Middle Archaic periods may be represented in some form in the currently inundated environment of Georgian Bay.

Site potential modeling for Late Paleo-Indian sites, dating from 11,400 to 9,600 B.P., tends to be located on well-drained, elevated areas with a southern exposure overlooking lower, more poorly-drained areas (Ellis and Deller 1990). Paleo-Indian sites generally consist of small encampments. Paleo-Indian peoples were nomadic, following the annual cycles of animals and plants, such as migration routes or harvest items (Ellis *et al.* 1990).

The Early Archaic period, dating from 10,000 to 8,000 B.P., is best typified by its formal stone tool assemblage. Stone tool landmarks for this period include corner notched, side notched and bifurcate based projectile points. The Early Archaic people were attracted to lakeshore margins for exploitation of still water vegetation and fish and waterfowl. The Early Archaic people, like their Paleo-Indian ancestors, were also largely nomadic hunters and gatherers.

The Middle Archaic period dates from circa 8,000 to 4,650 B.P., and is also recognized by its characteristic stone tool assemblage. This period is associated with stemmed projectile points and a marked increase in the use of rough and ground stone technology over the Early Archaic (Ellis *et al.* 1990). Included in the latter are fully ground and polished stone tools such as bannerstones, and items such as grooved axes and net sinkers. Site location preference is similar to that of the Early Archaic period peoples, except towards the end of the period where there is a transition from temporary campsites to more territorial settlements.

The probability of locating prehistoric artifacts in an inundated environment is governed by several factors. There is a strong possibility that heavier artifacts such as rough and ground stone might survive inundation processes. Current strength, both past and present, will also factor into the determination of the in situ status of any recovered artifacts. A current with a 1 to 2 knot strength will move fine granular material and will probably be able to bury something like a fishing net. A 5 to 6 knot current will move heavy granular material. Considering this information, it is unlikely that any artifacts would be located in situ within the channels themselves. However, artifacts can reposition themselves into crevices, behind obstacles, and into small potholes with the assistance of the current. Certainly, current has been shown to not totally eliminate the presence of artifacts, as documented in the recovery of historic artifacts at the French River.

The probability of locating organic artifacts (wood and bone) is quite low. These lightweight artifacts would be subject to displacement, but as well, their organic nature in a wet environment would assist in the process of degradation and total decomposition. However, there remains the possibility that these light organic artifacts may have been displaced to a location where burial ensued, thereby protecting them in an anaerobic environment.

Rate of inundation and receding lake levels also act as a possible displacement factor for artifacts. It is quite likely that receding and rising water levels correspond closely to what the Great Lakes were experiencing in the late 1900s, and will not adversely affect the in situ nature of stone artifacts.

The 1999 field season recovered its first potential artifact. A sample of fire-cracked rock was recovered from a 30-m water depth along a submerged embayment southwest of Middle Island. A C14 sample could not be obtained from the rock as it was covered with zebra mussels whose organic filaments contaminated the sample. Nor has it been ascertained whether this fire-cracked rock derives from a cultural phenomenon (such as a hearth), or whether it is part of a natural feature (such as a forest fire-lightning strike). It is expected that continued investigation in this area may further define the interpretation regarding this currently labeled ecofact.

Another facet of archaeological investigation based on low stand water levels is the investigation of alternative travel routes for Paleo-Indian groups. Fedje and Josenhans (Isabella 1999:D9) are doing studies of this type in the Queen Charlotte Islands, based on a much earlier time period. The low stand water levels of Georgian Bay would have provided many alternative routes for Paleo-Indian and Archaic populations.

The analysis of animal and plant populations can be used to assist in defining potential site locations. For example, the Paleo-Indian people are identified as having occupied positions where they seasonally intercepted migratory caribou (Rangifer taranadus). It is hypothesized that caribou frequented the area of currently inundated Georgian Bay. Brian Gordon (1976) determined through his studies of barren land prehistoric people and caribou that there were five criteria necessary for man and caribou interaction. These criteria include: the necessity for withdrawal of the ice from the area, the occurrence of sufficient glacial melt water and fluvial drainage, the presence of well-established vegetation, time for new herd migration and general herd adaptation, and time for human hunting bands to align with the caribou migration patterns.

These requirements appear to have been met for the study area. The glaciers had receded and fluvial drainage had been established through the location of four channels. It is true that evidence of in situ trees in a submerged environment alone, would not meet the established vegetation criteria. In fact, Dr. Doug Larsen (personal communication 1997) has stated that 65 years is needed for a tree to establish itself on bare rock. However, given the three low water open water years (respectively 600, 300 and 900 years), this criteria also appears to have been met. The remaining two criteria are also both time dependent. Thus, conditions in the prehistoric inundated environment of Georgian Bay were ideal for caribou and man interaction.

As yet, the project's only tangible archaeological lead lies in the discovery of the sample of fire-cracked rock, but even this, has not been confirmed as a cultural artifact. The possibilities for the discovery of human habitation, activity, and cultural remains are real, and it is this reality that is the driving force in the continuation of this multi-disciplinary approach to the study of the geological and archaeological science of the low water stages of Georgian Bay.

Acknowledgments

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12.

Insights into the Early Peopling of Northwestern Ontario as Documented at the Allen Site (EcJs-1), Sioux Lookout District, Ontario

Jean-Luc Pilon and Luke Dalla Bona

Abstract

The Allen site, located northeast of Sioux Lookout in the Kenora District of Ontario, is a multi-component site with occupations spanning the Woodland to Late Palaeo-Indian time periods. Test excavations undertaken in 1997 showed the existence of 8,100-year-old palaeosols that contained debitage and calcined bone fragments. The trihedral adzes that were found on the beach in front of the site, are characteristic of the Caribou Lake Complex in Manitoba, and their origins are likely from these ancient soil horizons. In addition to the prospect of studying unmixed archaeological deposits from the Late Palaeo-Indian period, the Allen site forces us to rethink our site testing methods, since these palaeosols were located at more than 90 cm below the modern surface. Such depths are never reached by current boreal forest archaeological methodologies.

Résumé

Le site Allen, situé au nord-est de Sioux Lookout, dans le district de Kenora en Ontario, est un gisement à occupations multiples qui s'étalent du Sylvicole jusqu'au Paléoindien supérieur. Des sondages effectués en 1997 démontrent l'existence de paléosols remontant à 8 100 A.A. qui contiennent des éclats de taille et de l'os calcinés. Ces paléosols sont donc en toute probabilité la source des herminettes « trièdres », typiques du complexe Caribou Lake du Manitoba, qui ont été trouvées sur la plage devant le site. En plus de nous offrir la possibilité d'étudier des dépôts archéologiques anciens qui n'ont pas été mélangés avec les restes d'occupations plus récentes, le site Allen nous incite à repenser nos méthodes de prospection

The Late Palaeo-Indian Great Lakes: Geological and Archaeological Investigations of Late Pleistocene and Early Holocene Environments. Edited by Lawrence J. Jackson and Andrew Hinshelwood. Mercury Series, Archaeology Paper 165. Canadian Museum of Civilization. Gatineau, Quebec, 2004.

car les paléosols se trouvent à une profondeur de plus de 90 cm sous la surface actuelle, une profondeur qui n'est jamais atteint par les sondages en milieu boréal.

Introduction

Archaeological research within the Central North American Subarctic in general, has long suffered from the neglect and disinterest of academic or museum-based investigators (Pilon, Riddle and Ross 2000). Quite often, the Subarctic archaeological record is characterized by meagre sites with the remains of multiple re-occupation episodes apparently mixed together in a single, thin stratum. This renders the extraction of meaningful cultural information onerous, if not impossible.

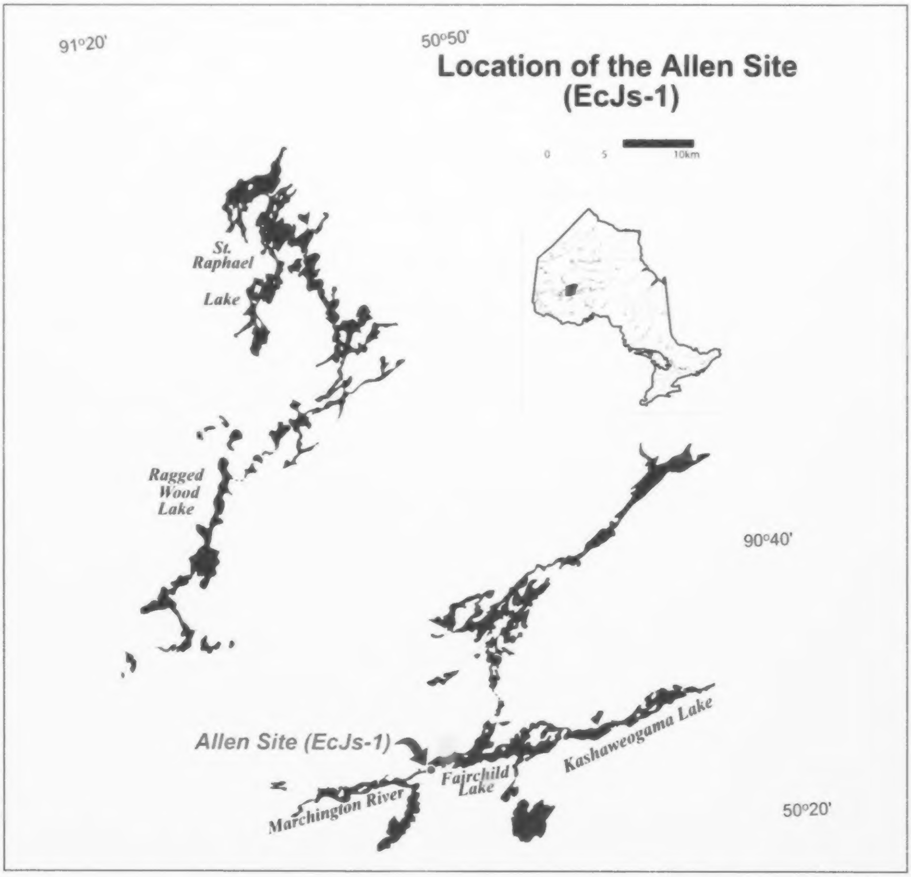

91°20'
50°50'
Location of the Allen Site (EcJs-1)
0
5
10km
St. Raphael Lake
Ragged Wood Lake
90°40'
Allen Site (EcJs-1)
Fairchild Lake
Kashaweogama Lake
Marchington River
50°20'

Figure 12.1 Map of Northwestern Ontario Study Area Showing the Location of the Allen Site .

Another challenge to Subarctic archaeology lies in the realm of chronological control. A quick assessment of the web site "Mapping Ancient History" (Natural Resources Canada 2000), reveals that the region north of Lake Nipigon, east of Lake Winnipeg, and west of the Québec border, contains less than 50 individual radiocarbon dates for all time periods combined. This is hardly a solid basis for rewriting the prehistory of the region.

The Allen Site (EcJs-1), with nearly a meter of stratigraphy extending back to at least 8,100 B.P., is an archaeological site that challenges some of the preconceptions regarding Subarctic archaeological sites. The work that has been undertaken is still at a very preliminary stage, and indeed the site's condition may preclude substantial additional investigations, but it does offer potential insights into Subarctic archaeological research methodologies, as well as, into the early peopling of the area.

Site Location

Fairchild Lake is situated just south of the height of land dividing drainage systems flowing north and west, which characterize the landscape in the vicinity of Lac Seul in northwestern Ontario. Fairchild Lake, along with contiguous Kashaweogama Lake, constitutes the headwaters of the Marchington River (Figure 12.1). This is a small stream, which flows into Minnitaki Lake near the community of Sioux Lookout to the southeast and, eventually into the westward flowing English River-Winnipeg River drainage system. The eastern end of

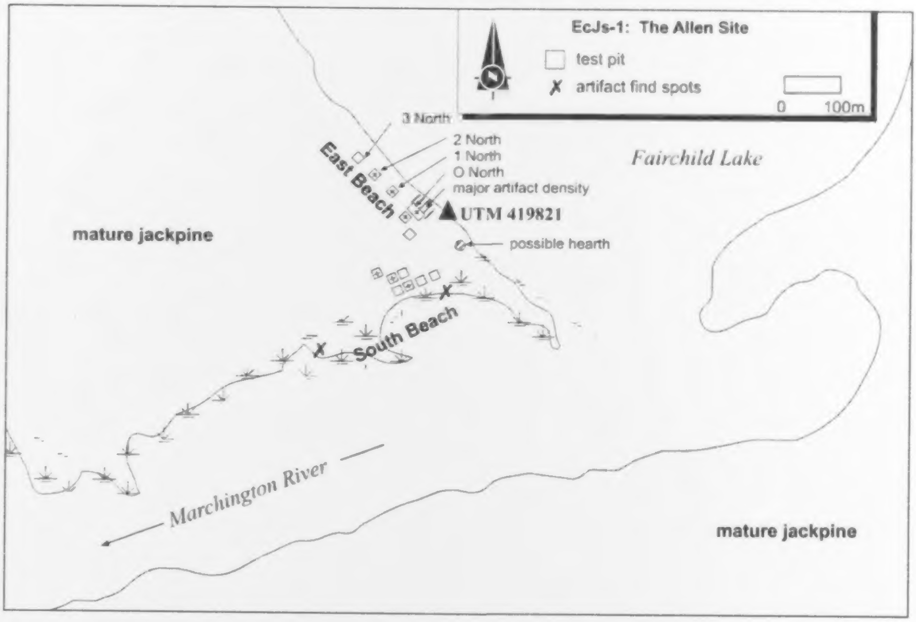

EcJs-1: The Allen Site
test pit
artifact find spots
0
100m
3 North
2 North
1 North
O North
major artifact density
UTM 419821
possible hearth
East Beach
South Beach
Fairchild Lake
mature jackpine
Marchington River
mature jackpine

Figure 12.2 Site Map Showing 1995 Find Areas.

Kashaweogama Lake is roughly 5 km from the shore of Savant Lake, which feeds into the Albany River system.

The site is located on a large sand flat on the north side of the outlet of Fairchild Lake, where a fine sand beach extends approximately 1 kilometre in a north/south direction. An active sand spit is building at the southern end of the beach where the outflow of Fairchild Lake is located. Downstream from the spit, beaches and marshes are forming and filling.

History of Investigation

In 1995, Luke Dalla Bona (1995, 1996) carried out a surface collection and identified two distinct localities (Figure 12.2). In total, 133 artifacts were gathered from the surface and from test pits. These included debitage, cores and core fragments, scrapers, side-scrapers, unifaces, bifaces and distinctive trihedral adzes. This last artifact category is usually linked to the Caribou Lake Complex in nearby southeastern Manitoba. Raw materials included fine-grained cherts, greywacke, schist, greenstone, and jasper taconite.

Several test pits were excavated and yielded quite mixed results. Some showed absolutely no buried soil layers while others attested to many periods of apparent stability (palaeosols) followed by the deposition of significant quantities of sand.

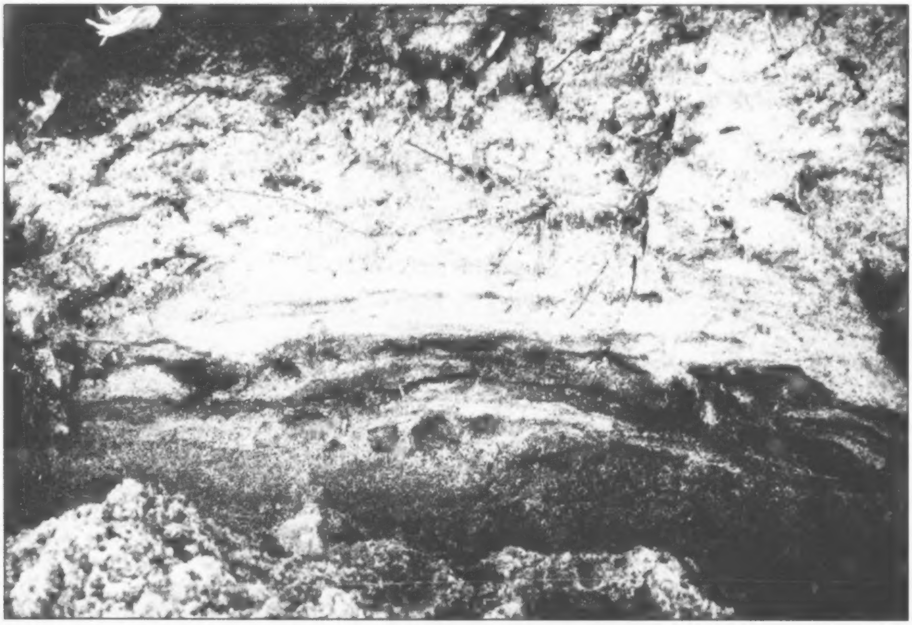


Figure 12.3 Photo of a 1995 Test Unit with Palaeosols.

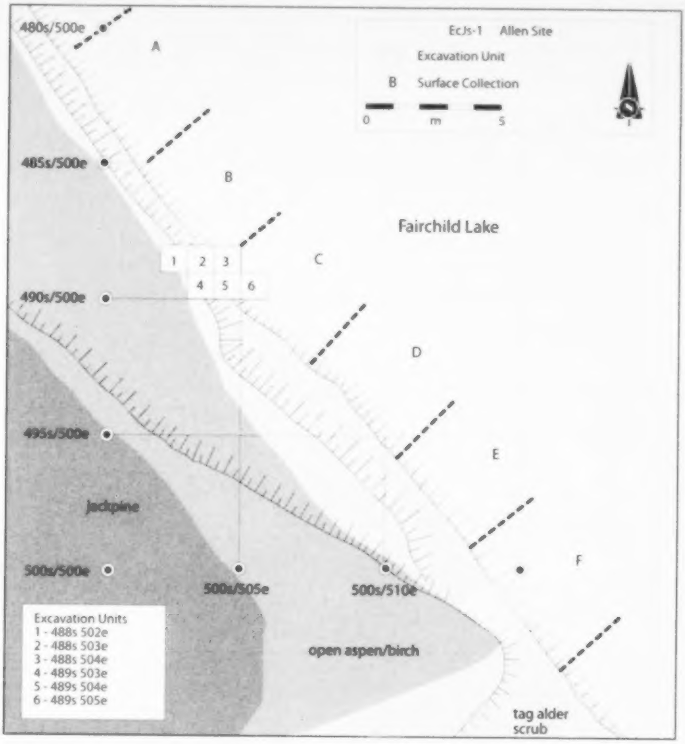
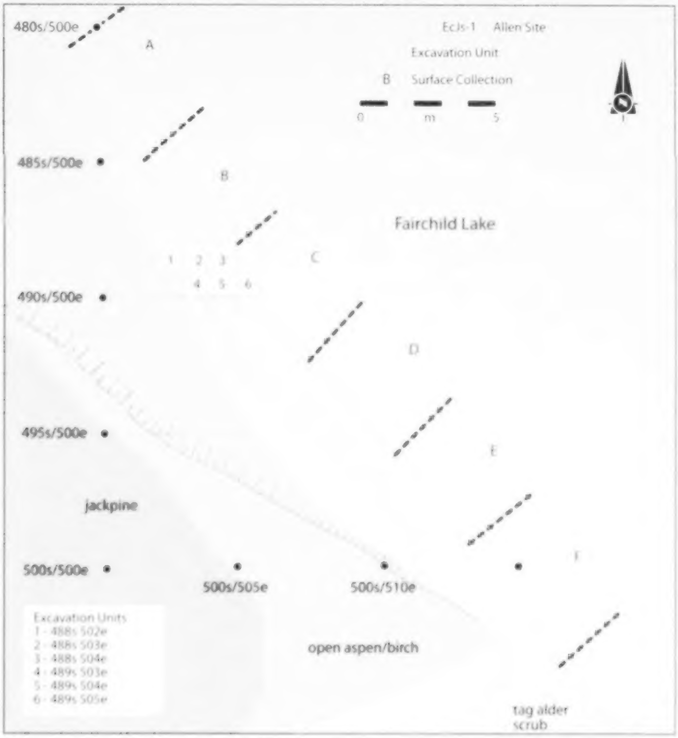

480s/500e
A
EcJs-1 Allen Site
Excavation Unit
B Surface Collection
0 m 5
485s/500e
B
Fairchild Lake
1 2 3
4 5 6
C
490s/500e
D
495s/500e
E
Jackpine
F
500s/500e
500s/505e
500s/510e
Excavation Units
1 - 488s 502e
2 - 488s 503e
3 - 488s 504e
4 - 489s 503e
5 - 489s 504e
6 - 489s 505e
open aspen/birch
tag alder scrub

Figure 12.4 Sketch Map of the 1996 Test Unit .

In one test pit along the edge of the beach, the face of the terrace was being undercut by the high waters from the lake, causing minor slumping of the terrace edge. The soil profile was consistent with this observation as soil lenses could be seen to dip toward the lake. Approximately 50–60 cm below the surface, a swirling series of soil lenses was encountered (Figure 12.3). This layer varied in thickness but ranged between 5 and 10 cm. Immediately below it was a rocky/gravelly layer at the interface of which artifacts were excavated *in situ*. Numerous flakes, large pieces of raw material including cherts, quartzes and greenstones were recovered.

In 1996, Dalla Bona (1997) returned to the Allen site and excavated a single test unit (approximately 6 square metres in surface area) at the edge of the eroding terrace behind the active beach. Because this was in an area that had previously yielded a great number of artifacts, there was the expectation that the source of these artifacts would be identified. At a depth of 40 to 50 cm, he encountered a dense deposit of implements (including additional adzes and adze fragments, and the tip of what might be a native copper awl), debitage, cobbles and fire-cracked rocks (Figure 12.4). The artifacts were distributed in a dense concentration to one side of a line running more-or-less parallel to the eroding terrace front. There


480s/500e
A
EcJs-1 Allen Site
Excavation Unit
B Surface Collection
0
m
5
485s/500e
B
Fairchild Lake
1 2 3
4 5 6
C
490s/500e
D
495s/500e
E
jackpine
500s/500e
500s/505e
500s/510e
F
Excavation Units
1 - 488s 502e
2 - 488s 503e
3 - 488s 504e
4 - 489s 503e
5 - 489s 504e
6 - 489s 505e
open aspen/birch
tag alder
scrub

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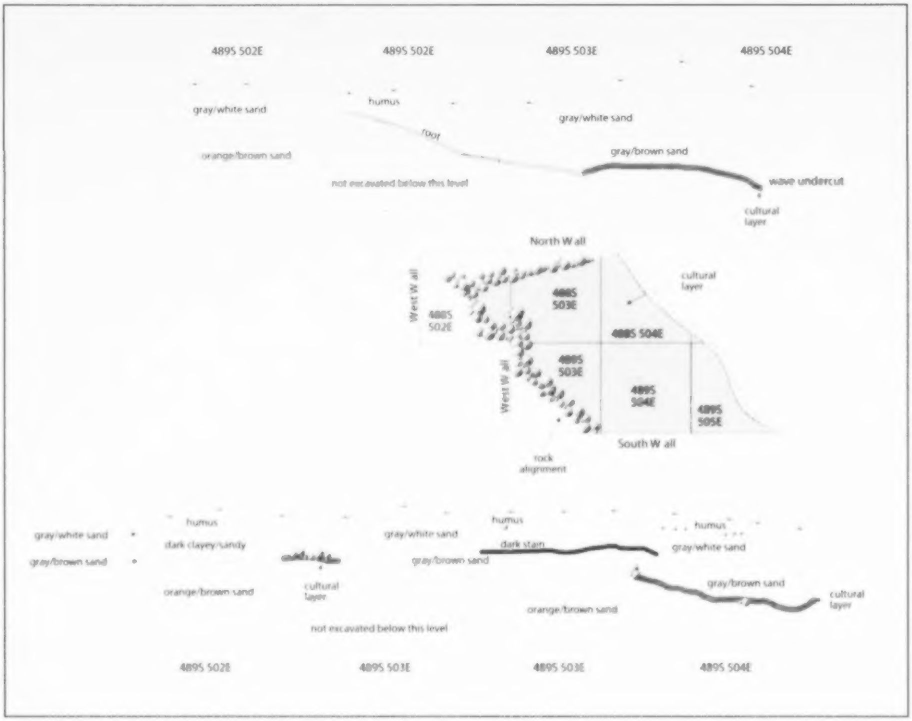
489S 502E
489S 502E
489S 503E
489S 504E
humus
gray/white sand
root
gray/white sand
orange/brown sand
gray/brown sand
not excavated below this level
wave undercut
cultural layer
North Wall
West Wall
cultural layer
488S 502E
488S 503E
488S 504E
489S 503E
489S 504E
489S 505E
West Wall
South Wall
rock alignment
humus
humus
humus
gray/white sand
dark clayey/sandy
gray/white sand
dark stain
gray/white sand
gray/brown sand
gray/brown sand
gray/brown sand
orange/brown sand
cultural layer
orange/brown sand
cultural layer
not excavated below this level
489S 502E
489S 503E
489S 503E
489S 504E

Figure 12.5 Floor Plan and Profiles of the 1996 Test Unit.

also appeared to be a "corner" or a sharp and distinct turn in the concentration at one end of the excavation (Figure 12.5). Faced with such an unusual distribution, Dalla Bona wondered if this might not represent the remains of the interior of some kind of a human-made structure (Dalla Bona 1997:40).

In 1997, Dalla Bona invited Jean-Luc Pilon to join him in his investigations of the Allen site (Pilon 1998; Pilon and Dalla Bona 1998). Pilon was particularly intrigued with the test excavation's artifact distribution that brought to mind the effects of ice rafting, which had been observed along the shores of the Mackenzie River. Additionally, there was the possibility that other groups had used the site area, since ceramics had been found elsewhere along the beach, and this pointed to the importance of isolating these sources stratigraphically.

The excavation of a series of test units was undertaken on the terrace behind the active beach. Artifacts, albeit in modest quantities, were found in a number of these. In all cases, the artifacts, which were mostly lithic debitage, but also some ceramic sherds, occurred in the upper 10 cm of the units. This established that, in addition to the ancient adze makers, others in much later times had used the terrace. To better understand the stratigraphic context of the 1996 artifact deposits, three trenches were excavated from the edge of the terrace in 1997 (i.e. from the rear of the active beach, towards the interior of the terrace). Once again,

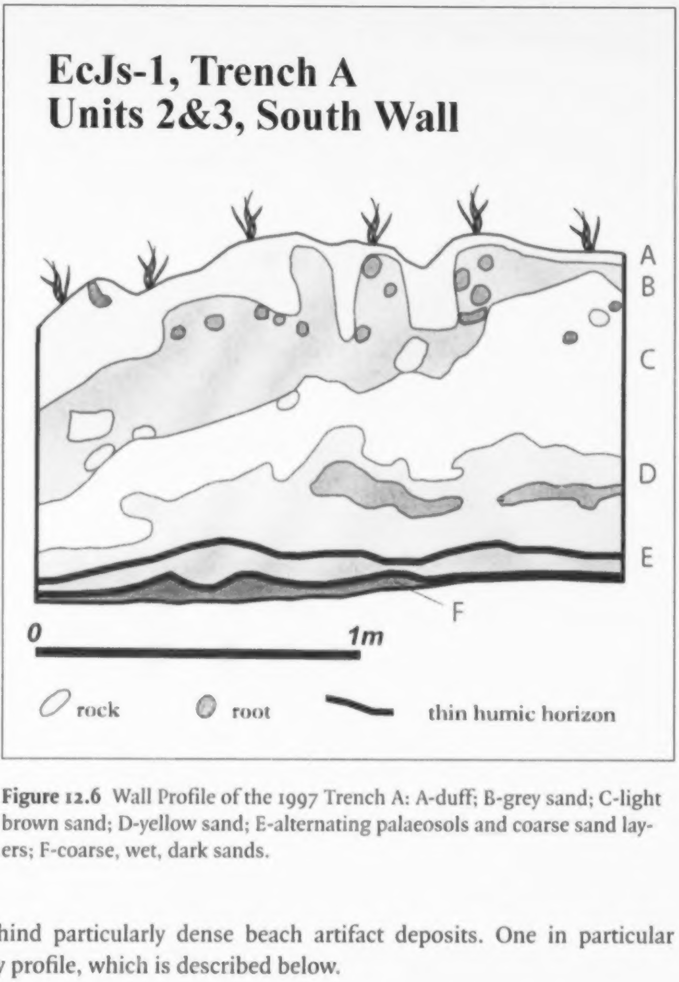

Figure 12.6 Wall Profile of the 1997 Trench A: A-duff; B-grey sand; C-light brown sand; D-yellow sand; E-alternating palaeosols and coarse sand layers; F-coarse, wet, dark sands.

these were located behind particularly dense beach artifact deposits. One in particular (Trench A) yielded a key profile, which is described below.

Stratigraphy and Artifact Distribution–Trench A

In the upper centimetres of the profile, a small number of small stone flakes and minute fire-cracked rock fragments were found (Figure 12.6). This confirmed the test pit results elsewhere on the terrace and were clearly indicative of a relatively recent occupation centered somewhere nearby.

Another artifact-bearing layer of debitage, fire-cracked rocks, and ceramics, was found at a depth of some 30 to 40 cm (Figure 12.7), which was not unlike the depth of the 1996 excavations found by Dalla Bona. However, as excavation of this layer proceeded towards the front of the unit, a definite sloping of the layer indicated that slumping was affecting the vertical location of the artifacts from this occupation, which also included ceramics.

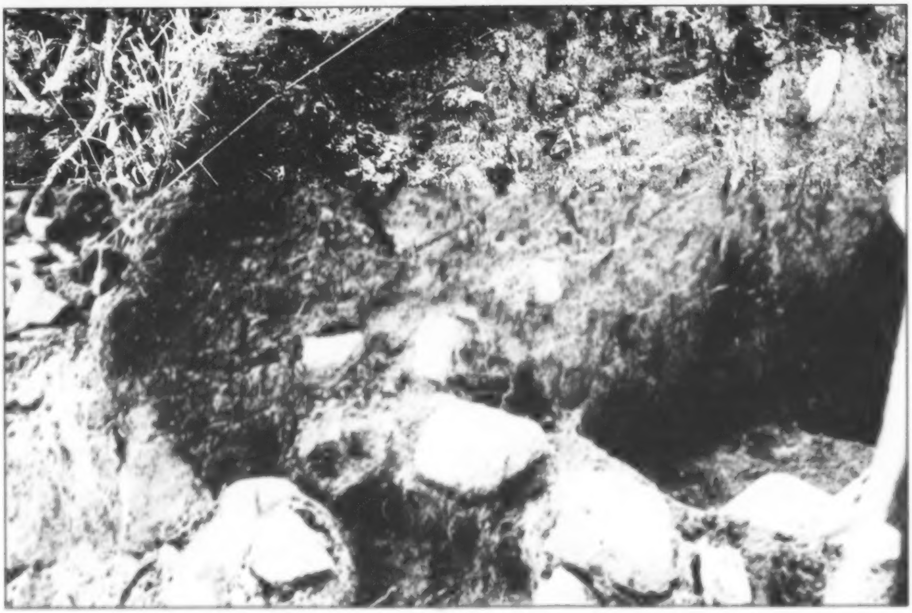

Figure 12.7 Photo of the Trench A Wall Showing Fire-Cracked Rock of an Occupation 30–40 cm Below the Surface; Ceramics were Associated with these Rocks.

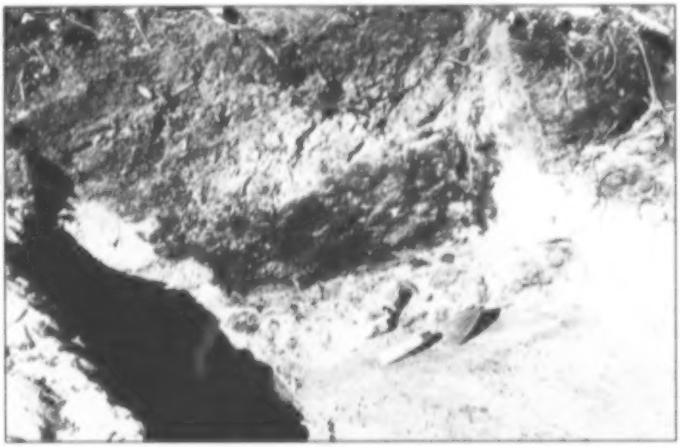

Figure 12.8 Photo of the Dense Concentration of Artifacts at the Rear of the Active Beach .

In most circumstances, excavations would have ended there, since it was apparent that sterile beach sands had been reached. However, the front part of this trench included the very back of the active beach where, under 15 to 20 cm of beach sand, a dense concentration of

Figure 12.9 In Situ Flakes in the Buried Palaeosols.

artifacts and fire-cracked rock had been found (Figure 12.8). The slumping ceramic bearing layer seemed to be the source of these beach artifacts. On the other hand, it was also possible that the beach artifacts were part of a more deeply buried and undisturbed layer extending back into the terrace. Consequently, excavations in the rear portion of the trench continued in what were thought to be deposits of geomorphological interest only.

To our surprise, at a depth of between 77 and 82 centimetres below the surface, two good biface trimming flakes were discovered (Figure 12.9). These occurred in dark, 15-cm thick, iron-stained sand, and excavating just a few centimetres deeper, revealed a number of palaeosols. More flakes were found in and between these palaeosols, in addition to small pieces of charcoal. The relative thinness of the palaeosols and the sand levels allows for the possibility of artifacts being attributable to different layers. At a depth of between 90 and 100 centimetres, the water table was reached.

As a result of this work, three distinct occupation layers were seen to be contributing to the deposit of beach artifacts, which appear to have been reworked into dense clusters at the back of the active beach. Thus, the site is clearly multi-component and the beach collections evidently representative of several distinct occupational episodes.

Artifact Descriptions

Given that the largest proportion of the collection from the Allen site was gathered from the surface, only those artifacts that appear to have bearing on the present theme will be described. Admittedly, the sample is highly biased, yet those elements selected for further discussion share some distinctive characteristics worthy of description. In particular, we present information on the adzes that have been found at the Allen site, as well as lanceolate point fragments, which are believed to relate to these, both culturally and chronologically.

Table 12.1 Allen Site Trihedral Adze Metrics

Art. No.	284	285	652	9	10	287	490	286	725	101	735
Condition	Comp	Inc	Comp	Comp	Comp	Inc	Inc	Inc	Inc	Inc	Inc
Max. L (cm)	11.4	11.1	11.8	11.1	7.1	10.3	5.9	8.2	4.2	3.9	10.2
Max. W (cm)	3.4	3.7	5.6	5.6	3.2	3.0	3.4	3.5	2.9	3.0	5.5
Max. T (mm)	32	40	33	36	18	25.5	19	32	23	13	18
Lat. Ang (deg.)	73,	92,	114,	79,	47,	73,	69,	71,	58,	48,	60,
at mid-point	73	90	51	81	68	62	69	74	85	55	49
Weight (g)	147.5	221.6	262	254	50	113.5	58.5	78	29.5	18	101

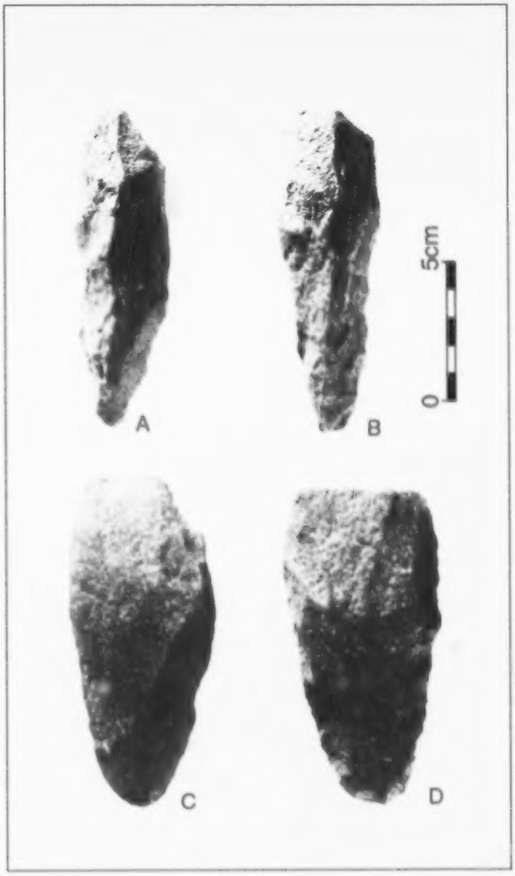

Figure 12.10 Trihedral Adzes.

Trihedral Adzes (Figure 12.10, 12.11 and Table 21.1)

Six complete (4) or near-complete (2) trihedral adzes are included in the collection. Substantial fragments from another four artifacts exhibit traits sufficient to include them as trihedral adze fragments.

The raw materials used for 9 of the 10 specimens are coarse-grained, metamorphic materials, not unlike metabasalt, while one is manufactured from a more fine-grained, black, siliceous material, which could be described as cherty.

The ventral surfaces of seven of the implements are flat and suggest either natural cleavage planes or flat, unaltered surfaces of large pieces of raw material (Figure 12.12). The dorsal surfaces of the adzes (with the exception of the cherty one) were created by steeply

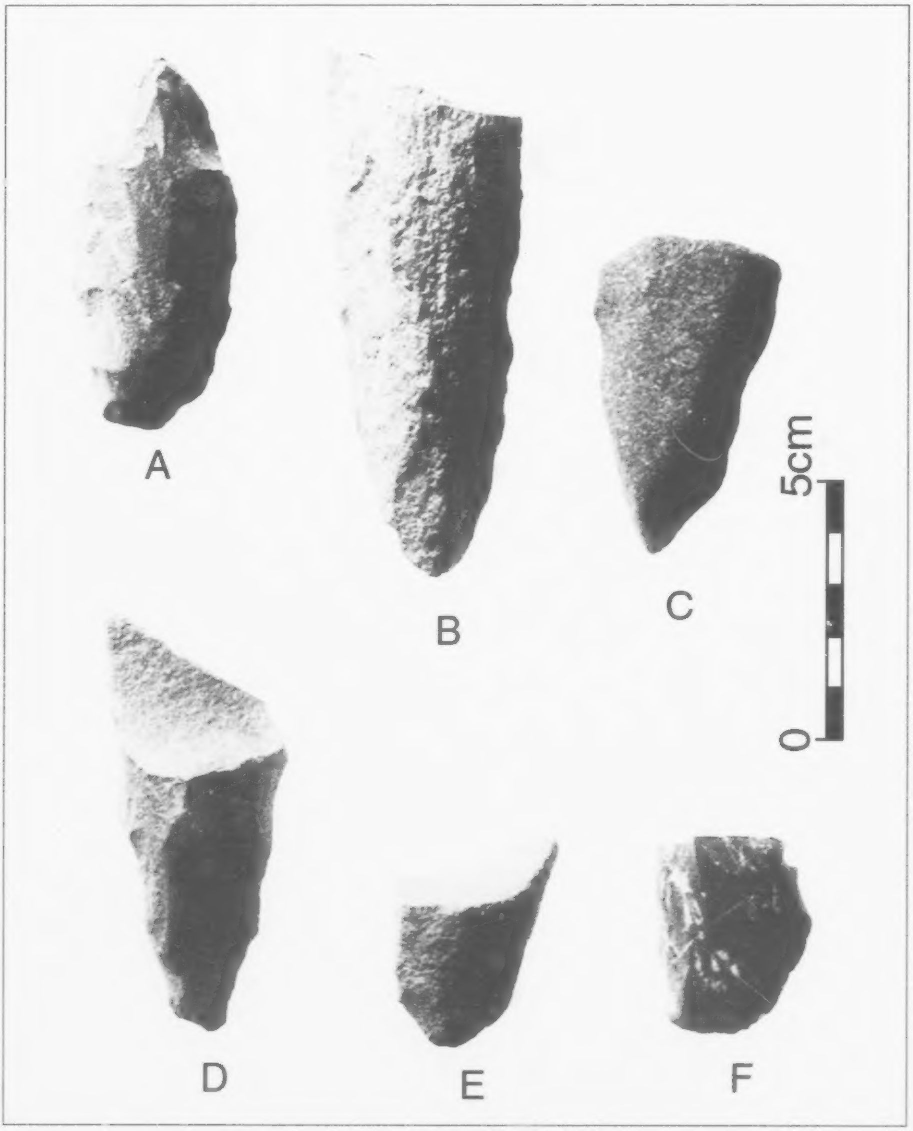

Figure 12.11 Trihedral Adze Fragments.

retouching towards a central ridge from the ventral surface, producing a markedly triangular, carinated dorsal side. Thus, the sample consists of tools, which share a number of characteristics, not the least of which is their marked thickness following a line running the length of the dorsal surfaces of the implements.

EcJs-1:284 (Figure 12.10a): This is a complete specimen exhibiting a very flat ventral surface and a markedly carinated dorsal portion. In plan view, the sides converge at one end to form a rounded point while the opposite end has apparently received blows at the tip from the dorsal surface, which removed at least one flake from the ventral surface to produce a much more blunted end. Additionally, there seems to have been a series of flakes removed on the dorsal side of the implement adjacent to the central flake scar at this same extremity.

EcJs-1:285 (Figure 12.10b): This specimen is broken but appears to be more than half-complete. The craftsperson who shaped this implement appears to have been intent on creating near-vertical sides, but these efforts were hampered by step fractures, which left significant masses of material overhanging. In plan view, the sides gradually contract towards a rounded point. The broken extremity exhibits a slightly concave surface at an angle approaching verticality.

EcJs-1:652 (Figure 12.10c): Unlike the two previous examples, this implement appears to have been extensively water-rolled, obscuring some surface characteristics. However, it seems clear that this tool was not as extensively shaped by flaking but rather, took advantage of the shape of the blank. Indeed, one whole side of the tool appears to consist of a single fracture surface, perhaps left from its detachment from a larger piece of raw material, and the opposite side also received only minimal shaping. In plan view, the sides converge to form a

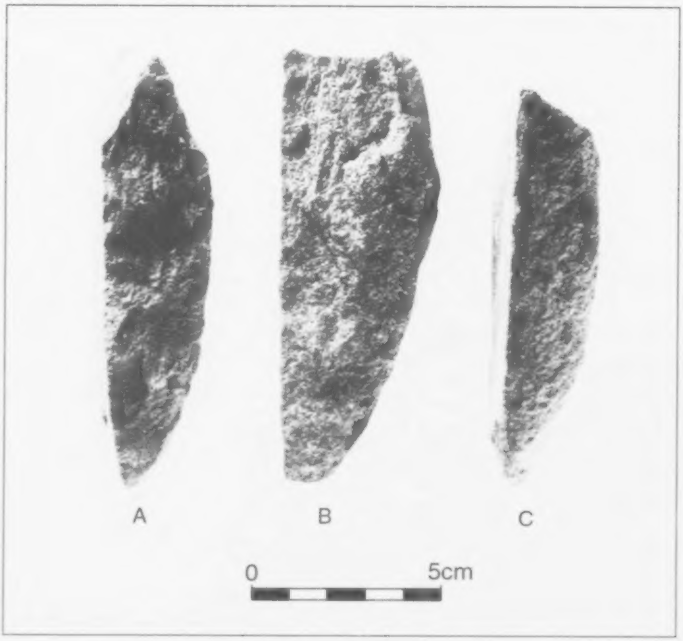

Figure 12.12 Profiles of 3 Trihedral Adzes.

broad, rounded point at one end while the opposite end has had some large flakes removed from the dorsal surface, creating a markedly squared end.

EcJs-1:9 (Figure 12.10d): Both the ventral and the dorsal surfaces of this tool have been flaked. The implement is thick but the sides, which converge at the dorsal ridge, are not as steep as on other specimens. In plan view, the typical converging edges form a broad, rounded point, which has been shaped on both the ventral and dorsal sides. The opposite extremity is markedly square and formed by extensive dorsal and ventral chipping.

EcJs-1:10 (Figure 12.11a): This specimen is especially remarkable by its significantly reduced dimensions compared to the other complete or, near-complete adzes. From a technological perspective, this adze distinguishes itself from most of the others in the fact that its ventral surface bears flake scars from the shaping or flattening of this face. Additionally, while the dorsal surface is comprised of two converging, steeply retouched faces, these do not actually meet to form a ridge, but stop short of meeting on either side of a flat residual exterior surface of the original blank. In plan view, the implement is more or less elliptical with both ends relatively rounded. One end has a marked bevel onto the ventral surface caused by the removal of at least two flakes from the tip area. Furthermore, this bevel served as a platform for the removal of a number of flakes, which extend onto the dorsal face of the tool.

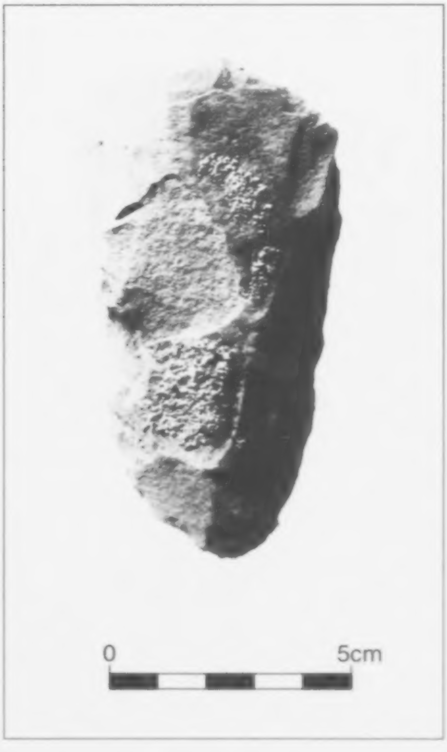

Figure 12.13 A Woodland Adze Associated with the 30-40 cm Occupation Level.

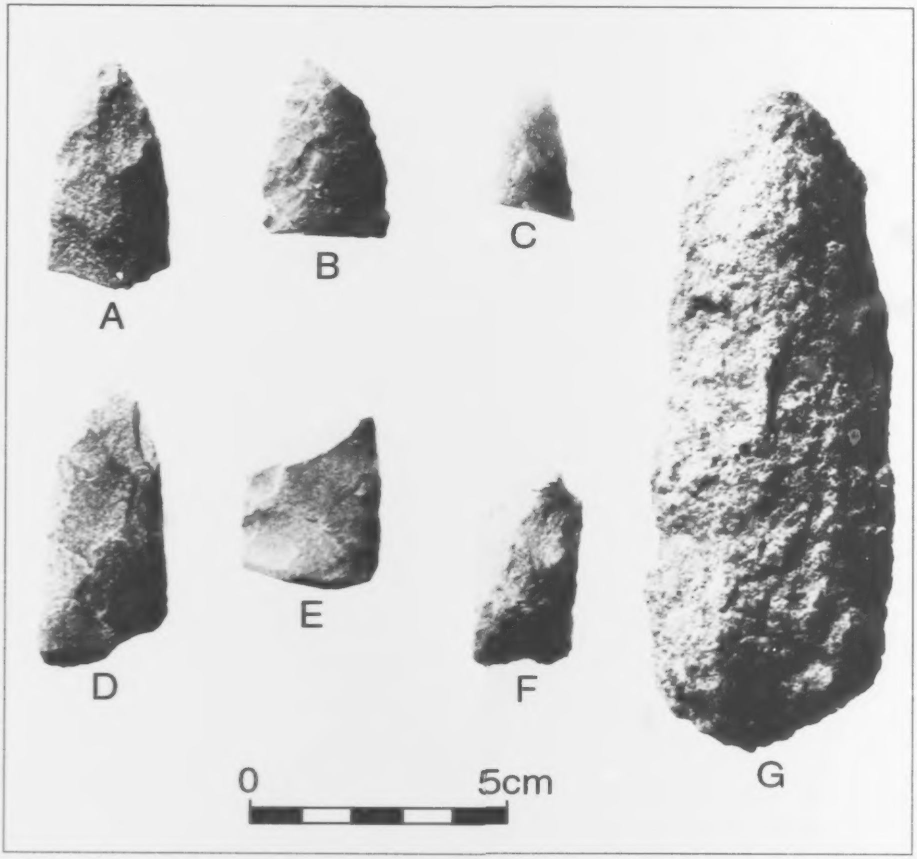

Figure 12.14 Lanceolate Points and Point Fragments.

EcJs-1:287 (Figure 12.11b): This adze appears to be more than half complete. The edges are steeply retouched and, near the rounded extremity, form a ridge. However, for most of its length, the sides meet a narrow flattened surface, which is parallel to the flat, even and smooth ventral surface. In all probability, this surface is the cortical surface of the blank. The break appears to have cleaved along some natural surface and forms a near vertical, oblique break.

EcJs-1:490 (Figure 12.11c): This is an extremity fragment from an adze manufactured from a tabular piece of raw material. It has suffered greatly from being rolled such that flake scars are difficult to perceive. However, in plan view, the piece consists of a rounded point. The sides are steeply retouched, meeting the flat surface of the tabular blank.

EcJs-1:286 (Figure 12.11d): This is also an extremity fragment with steep retouching of the sides, from the ventral surface meeting to form a dorsal ridge. The break is a large diagonal hinge fracture, suggesting that the pressure, which led to the breakage, was applied from the dorsal side of the tool. The extremity is a rounded point with at least two flakes removed from the ventral surface of the tool, initiated from the tip, and small flakes removed from the dorsal surface, initiated from the tip as well.

EcJs-1:725 (Figure 12.11e): This is the highly rolled and rounded extremity of a presumed adze formed by steeply retouching the sides towards a dorsal ridge. Both ventral and dorsal flake scars characterize the tip. The ventral surface is quite flat and likely a former cortical surface.

EcJs-1:101 (Figure 12.11f): This is the single example of a possible adze not made from a coarse-grained raw material, but rather from a much more silicious raw material. It also differs in the fact that the sides are not steeply retouched, nor is the ventral surface flat, but formed by flaking. The characteristic, which suggested its inclusion, is the ventrally bevelled rounded tip. This was formed by the removal of a single flake from the ventral surface using the dorsal surface as a platform, as well as, a series of short flake scars on the dorsal surface stemming from the rounded tip.

EcJs-1:735 (Figure 12.13): This adze was recovered from the 30 to 40 cm deep occupation layer as it was eroding at the front of Trench A. Its generally flat ventral surface reflects the nature of the blank and its dorsal face was shaped by marginal edge flaking. One extremity is a blunt, rounded, broad end. The presumed working end was formed by unifacially retouching the ventral surface from the dorsal face in the form of an arc. This working edge also exhibits wear from extensive use, resulting in a rounded and worn edge.

Lanceolate Points and Point Fragments

Among the many artifacts recovered from the surface of the beach deposits, as well as, in the 1996 test unit, were lanceolate points and point fragments (Figure 12.14). There is no physical reason to suggest that these should be associated with the trihedral adzes, and there may even be some reasons to question whether some of the proposed examples are indeed from lanceolate implements at all. However, as currently understood in this region, lanceolate projectile points are not typical of either Archaic or Woodland cultures. Given their association with trihedral adzes elsewhere in the Subarctic/Boreal forest, they are presented as possible corroborative data supporting the temporal and cultural attribution of the trihedral adzes.

While no single specimen is complete, they all share the common characteristic of being elongated with more or less parallel lateral edges and no obvious hafting accommodation at the base (no notching or stemming). One specimen is manufactured from yellow quartz while the remaining five specimens are manufactured from a variety of lithic materials (no two seem to be made from the same material) that are suggestive of metasedimentary stones such as siltstone.

Radiocarbon Dating

Since this fieldwork was understaken, charcoal samples from the two palaeosols were submitted for radiocarbon dating. Because of the relatively small amounts of charcoal actually recovered, they were processed through the use of the AMS technique. The dates were 8,050 ± 80 B.P. (Beta-111666) and 8,160 ± 80 B.P. (Beta-111667).

These results were clearly exciting. It must be pointed out that these radiocarbon dates relate to the palaeosols *per se* and not to the human occupation, since the charcoal did not come from a hearth feature or some other single moment that can be definitely linked to the people who lived there. However, a working hypothesis is that the people lived on the site when these palaeosols were exposed surfaces and further, that these surfaces did not remain exposed for more than a few centuries at the most. In other words, these dates are quite likely good approximations of the age of the occupation.

Palaeo-Environmental Considerations

The period during which the earliest dated level of the Allen Site was occupied corresponds to an environmentally very dynamic time in northwestern Ontario and in southeastern Manitoba. The nature of the changes that were taking place, as well as an appreciation of the pace at which these occurred, can be gleaned from regional geological discussions of the Lake Agassiz basin and from palynological studies carried out in the general study area.

A scant four centuries or less, prior to the earliest occupation so far identified at the Allen site, the remnants of the continental glacier were still present in the region, a few hundred kilometers to the north. It was rapidly disappearing, and glacial lake Agassiz was reaching its largest extent (Dyke and Prest 1987; Map 1703A). The Allen site area had only been freed from Agassiz waters a few centuries prior to this.

By 8,000 B.P., glacial ice and glacial lakes had both disappeared from northern Ontario, but were replaced by a southern extension of Hudson Bay into the lowlands surrounding that body of water. Even today, Hudson Bay has been shown to have an effect on weather, causing particularly harsh patterns along the bottom of that body of water.

Palynological investigations at a number of lakes in northwestern Ontario (Björck 1985) have shed additional light on the specific nature of the environment at the time of the site's earliest known occupation. Two of these lakes, Sioux Pond and Indian Lake, are within 100 km of each other, with the Allen site more or less equidistant between the two.

At Sioux Pond, the earliest levels are on the order of 10,000 B.P., and are characterized by a park-tundra or tundra-forest vegetation thought to be more reflective of the physiographic setting than of climatic factors. It is believed that sometime between 9,900 and 9,500 B.P., a boreal spruce forest quickly replaced this spectrum. However, the important pollen zones in this diagram are 3b (9,200 to 8,300 B.P.) and 3c (8,300 to 7,000 B.P.). A pine dominated boreal forest with spruce and birch characterizes the former period. The latter period is marked by a reduction in spruce, and an increase in juniper and ash pollen show that this period might have been drier and warmer than before or after. The slightly higher herb pollen values also indicate that this was the time of prairie expansion southwest of Sioux Pond" (Björck 1985:862). Bison remains found near Kenora, to the southwest of the study region and dating to 4,850 B.P., similarly attest to an expansion of grasslands into northwestern Ontario (McAndrews 1982)

In contrast to the Sioux Pond diagram, the record of the Indian Lake pollen core begins at approximately 9,300 B.P., with a short-lived colonizing assemblage of herbs along with spruce, willow, and larch. This was replaced by a spruce and larch-dominated forest lasting until about 8,800 B.P., which in turn, was succeeded by the pine and birch forest of Zone 13a (8,800 to 7,400 B.P.). Prairie pollen does not reach the area in significant amounts until sometime between 7,400 and 6,500 B.P.

The pollen diagrams from Sioux Pond and Indian Lake show a fairly rapid south to north spread of plant species indicative of a forest dominated by pine (jack/red) and birch (8,800 to 6,100 and 6,900 to 6,000 B.P. respectively). In both instances, spruce- dominated boreal forest types characterized the preceding forest types. In general, at the time of occupation, the significant amount of herb pollen, at least at Sioux Pond, may indicate "that this was the time of prairie expansion southwest of Sioux Pond." This, in turn, is likely reflective of a broadly recognized dry and warm period which "seems to have ended sometime between 7,000 and 6,000 years B.P." (Björck 1985:869).

Discussion

Although the sample of artifacts from the deeply buried occupation layer is small (36 pieces), it should be recalled that only approximately 2.5 square metres of surface area were exposed. Remarkably, there is a diversity of raw materials represented, from fine-grained cherts to quite coarse-grained materials. The latter are of some interest due to the fact that several of these specimens are biface thinning flakes. One in particular retains a completely ground platform area, similar to the type that would be found if removed from a partially ground artifact, such as the adzes found at the Allen site (albeit in surface or mixed contexts).

If related to the occupation(s) that left the trihedral adzes, the two radiocarbon dates provide the first known radiometric estimates from an acceptable context on this particular artifact type, which has been found in northwest Ontario and in adjacent Manitoba. Radiocarbon dates obtained from the Sinnock site in Manitoba, where similar trihedral adzes have been found, are problematical. Bison bone found essentially on the surface at this site, produced a date of 8,030 ± 160 B.P. (OxA-116), while two charcoal-containing, organic pit feature fill samples dated to 4,295 ± 90 B.P. (Beta 4869) and 4,500 ± 80 B.P. (OxA-508) respectively (CARD 2000). A fourth sample (OxA-115) yielded a modern date.

In Manitoba, trihedral adzes are a key artifact type in defining the Caribou Lake Complex, which is thought to date to late Plano times (Buchner 1979, 1981, 1984; Steinbring and Buchner 1980). The other two diagnostic elements are crude Agate Basin type projectile points and asymmetrical skinnings knives (Pettipas and Buchner 1983:439). Pettipas and Buchner have interpreted the Caribou Lake Complex as attesting to the movement of Plains adapted peoples into the fringes of the Boreal Forest. This movement was, atleast in part, as a response to the hotter and drier conditions of the Altithermal period, which led to growing desiccation of the central grasslands. The Complex had been tentatively dated to between 7,400 to 6,400 B.P., based on geomorphic and stratigraphic contextual information. More recently, Wright has assigned the Caribou Lake Complex to the Early Shield Archaic tradition (Wright 1995:121,122) and correctly points out the ambivalent nature of the dating and some of the projectile points that have been associated with this distinctive archaeological entity.

The distinctiveness of the adzes and their distribution in northwestern Ontario has been described and briefly discussed (Arthurs 1997; Fox 1977a, 1977b), and a possible correlation noted with a white pine maximum in that region. Further, it has been observed that such artifacts are not restricted to modern-day boreal forest contexts, but that examples have been found in the barrenlands of the Keewatin District (Wright 1976; Gordon 1996:228). Quite obviously, the felling and working of large trees was not an issue at the Grant Lake site or at other barrenlands sites. However, the common element is the early dating associated with these specimens, somewhere on the order of 7,000 to 8,000 B.P.

Conclusions

It is apparent that the Allen site implements were made and used by some of the earliest occupants of the region, as it was being liberated from the grip of the receding Laurentide Ice sheet and the succeeding waters of Lake Agassiz. The Allen site offers the possibility of acquiring a stratigraphically separated and unmixed collection from this critical time period.

The site may provide us with more information about some of the first inhabitants of Northwestern Ontario who entered the recently deglaciated landscape. What was the relationship with the somewhat earlier Palaeo-Indian groups who appear to have entered the Lakehead region from at least two sources (Julig 1994; McLeod 2000)? Clearly the lanceolate points suggest there was a relationship, but the dearth of adzes in the late Palaeo-Indian Complexes of the western end of Lake Superior (Ross 1991) provide few clues to the nature of that relationship. Thus, the potential significance of recovering buried and stratigraphically isolated and complete samples becomes even more pressing.

Similarly, how did the occupation of the Allen site relate to the somewhat later occupation of the Wapekeka site further north near the southern edge of the Hudson Bay Lowlands (Hamilton 1991; this volume)? At this location, Hamilton obtained three radiocarbon dates on human remains, which tightly span the period from 6,600 to 7,100 B.P. (CARD 2000). While no artifacts were found in clear association, a large, deeply grooved gouge was found nearby. At present, the Wapekeka human remains, the gouge, and indeed the site itself, lie at the edge of our understanding, and no relationships can be drawn with any other cultural manifestations in the region. However, like the Allen site occupants, the people who lived at Wapekeka were among the first to reach that region, and they may have faced similar problems adapting to these newly emergent lands.

Lastly, the Allen site, with its deeply buried strata, provides a very strong note of caution to archaeologists working in the Subarctic, who usually expect to find evidence of former human occupations in the active layer. Clearly, environmental conditions more than 8,000 years ago, and perhaps even more recently, were conducive to the deposition of large quantities of sand over the original occupation layers. While research aimed at explaining the mechanisms of this deposition is only in the early stages, the mere existence of such deposits suggests that other potentially quite ancient sites might have already been tested by archaeologists and declared void of early occupations.

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13.

Early Holocene Human Burials at Wapekeka (FlJj-1), Northern Ontario

Scott Hamilton

Abstract

During construction of an airstrip at the Wapekeka First Nation, a gravesite containing between 3 and 5 people was encountered. AMS radiocarbon dating of human bone indicates that the burials date to about 7,000 years ago. Except for a late Palaeo Indian human burial recovered from the Cummins Site in the Thunder Bay region (dating to 8,480 ±390 B.P., NMC 1216), these remains represent the oldest presently known in northwestern Ontario. A chitho and a full-grooved ground stone gouge were also recovered, both in disturbed context. While the history of deglaciation in far northern Ontario is not well understood, these early dates indicate that humans occupied the southern margin of the Hudson Bay Lowlands within about 1,500 years of deglaciation. The lithic recoveries also raise questions about the timing and nature of transitions from Plano to Archaic in far northern Ontario.

Résumé

Lors de la construction d'une piste d'atterrissage sur le territoire de la Première Nation Wapekeka, on a découvert un lieu de sépulture contenant trois à cinq personnes. La datation au radiocarbone (AMS) indique que ces ossements humains auraient été enterrés il y a environ sept mille ans. A l'exception d'une sépulture humaine datant de la fin de la période paléoindienne retrouvée à Cummins Site dans la région de Thunder Bay (datée 8 480 ±390 B.P., NMC 1216), ces ossements constituent les plus vieux restes humains actuellement connus et retrouvés au Nord Ouest de l'Ontario. Un outil à lame bifaciale ainsi qu'une gouge ont également été retrouvés, tous deux dans un environnement perturbé. Alors que la période de la fonte des glaces dans le Grand Nord ontarien n'est pas encore bien connue, ces datations précoces indiquent que des humains auraient peuplé le sud des Basses Terres de la Baie d'Hudson environ 1 500 ans après la fonte des glaces. Ces découvertes lithiques soulèvent également des questions quant au moment et à la nature de la transition entre les périodes Plano et Archaïque dans le Grand Nord ontarien.

The Late Palaeo-Indian Great Lakes: Geological and Archaeological Investigations of Late Pleistocene and Early Holocene Environments. Edited by Lawrence J. Jackson and Andrew Hinshelwood. Mercury Series, Archaeology Paper 165. Canadian Museum of Civilization. Gatineau, Quebec, 2004.

Introduction

In the fall of 1988, human skeletal remains were discovered at the Wapekeka First Nation during construction of an airstrip, under the direction of the Ontario Ministry of Transportation (MTO) (Hamilton 1991b). Wapekeka is a small Northern Ojibwa community located along the Fawn River (a tributary of the Severn River) about 20 km east of Big Trout Lake, and approximately 600 km by air north of Thunder Bay, Ontario (Figure 13.1). The airstrip was established upon a sand esker at the north end of the reserve (Figure 13.2), and overlooks a headwater lake (Weir Lake) that drains into the Fawn River.

The initial 1988 discovery is reported to have consisted of two human skeletons (designated as Burial Cluster A) that were exposed during mechanized removal of sediment along the airstrip margin. Local construction workers indicated that the skeletons were truncated

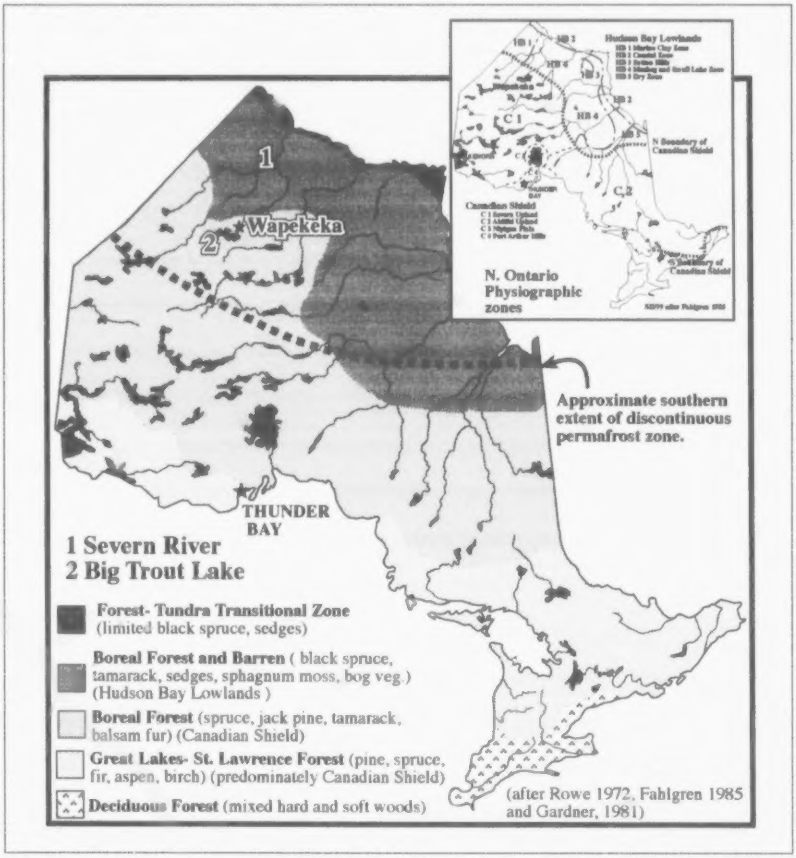

1
2
Wapekeka
N. Ontario Physiographic zones
Approximate southern extent of discontinuous permafrost zone.
THUNDER BAY
1 Severn River
2 Big Trout Lake
Forest- Tundra Transitional Zone (limited black spruce, sedges)
Boreal Forest and Barren (black spruce, tamarack, sedges, sphagnum moss, bog veg.) (Hudson Bay Lowlands)
Boreal Forest (spruce, jack pine, tamarack, balsam fur) (Canadian Shield)
Great Lakes- St. Lawrence Forest (pine, spruce, fir, aspen, birch) (predominately Canadian Shield)
Deciduous Forest (mixed hard and soft woods)
(after Rowe 1972, Fahlgren 1985 and Gardner, 1981)

Figure 13.1 Wapekeka, its environmental and Physiographic context in Ontario.

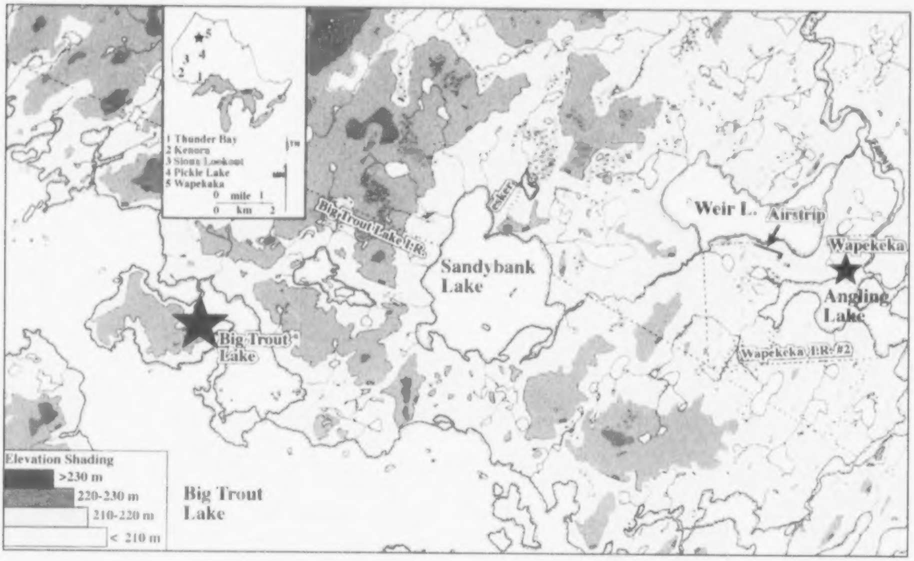

1 Thunder Bay
2 Kenora
3 Sioux Lookout
4 Pickle Lake
5 Wapekeka
0 mile 1
0 km 2
Big Trout Lake I.R.
esker
Sandybank Lake
Weir L.
Airstrip
Wapekeka
Angling Lake
Big Trout Lake
Wapekeka I.R. #2
Elevation Shading
>230 m
220-230 m
210-220 m
< 210 m
Big Trout Lake

Figure 13.2 Topography in the Wapekeka/Big Trout Lake region.

in the chest area, which resulted in the collapse of the skulls and upper bodies into the quarry pit, but leaving the lower limbs in place. The disturbed bones were collected and, on the advice of local Elders, they were reburied in the community cemetery. A bifacially worked stone tool was also recovered from the vicinity and was retained by a Band member. By late summer of 1989, continued wind erosion had exposed more human bone, leading the Band to stabilize the surface and protect the remains. The sand quarry pit was refilled and heavy equipment was used to scrape up and spread sediment over Burial Cluster A. Unfortunately, the latter earthmoving disturbed more human remains (designated as Burial Cluster B), most of which were also collected and reburied in the community cemetery.

With the discovery of Burial Cluster B, the Ontario Provincial Police and the Coroner were contacted, and the burials were determined to constitute a pre-contact unmarked gravesite. The Wapekeka Band Council contacted the Department of Anthropology at Lakehead University to address the antiquity and cultural affiliation of the finds, and also to determine whether more burials remained along the edge of the airstrip. The Wapekeka First Nation had retained a small sample of human remains from Burial Cluster B for radiocarbon dating, and these items form the basis of continued archaeometric investigations.

Emergency funding was received from the now-inactive Ontario Heritage Foundation for radiocarbon dating under its Northern Initiatives program. Three human bone fragments from Burial Cluster B yielded radiocarbon dates that cluster at nearly 7,000 B.P., and these demonstrate that human occupation occurred within about 1,500 years of local deglaciation. The Wapekeka Burial Site represents the earliest evidence of human occupation in the Severn River basin. When shared funding between the federal and provincial governments was established, the assessment and salvage project was conducted over twelve days in June of 1990. The details of the archaeological investigation are available in an unpublished report (Hamilton 1991b).

The Environmental Context

The Big Trout Lake/Wapekeka region is presently within the northern limits of the Northern Coniferous Forest, but within 150 km of the Hudson Bay Lowlands (Rowe 1972:43) (Figure 13.1). Black spruce is the dominant species, with localized stands of jack pine, tamarack, birch, white spruce, balsam fir and aspen also occurring where local conditions permit (Rowe 1972:43). The Wapekeka region is within the Severn Upland portion of the Canadian Shield and consists of Precambrian bedrock that is frequently mantled with glacial till and fine glacio-fluvial sediment (Figure 13.1). While better drained than the regions to the north, the Severn Upland contains a vast network of rivers, lakes and bogs that drain northward into Hudson Bay.

The Hudson Bay Lowlands consist of sedimentary bedrock mantled with marine sediments laid down when the Tyrrell Sea inundated it after about 8,000 B.P. The lowlands evince flat topography and poor drainage. Open spruce forest, with some deciduous vegetation, is found along the low alluvial banks of the rivers, while extensive tracts of wetland dominate the areas removed from the rivers. These wetlands are covered with black spruce, tamarack and patterned fens (Rowe 1972:20).

The Wapekeka region is within the discontinuous permafrost zone, with a humid climate consisting of long cold winters and short cool summers, and with an approximate 140-day annual growing season (Rowe 1972:154–156). The largest Boreal Forest mammals include black bear, moose and caribou. Medium-sized mammals include wolf, lynx, wolverine, fisher, marten, fox, beaver, and porcupine. Economically important small animals include snowshoe hare, muskrat, raccoon, weasel, mink, and otter (see Banfield 1974). A range of freshwater fish, migratory waterfowl and non-migratory birds were also important in the pre-contact past. It remains unclear to what degree the present biomass resembles that of the early Holocene period.

Glacial and Post-glacial History

Given the comparatively late deglaciation of far northern Ontario and the great antiquity of the Wapekeka burials, late Pleistocene and early Holocene events are particularly relevant. While only limited geomorphological study has been done in the region, a generalized reconstruction is possible (see Dyke and Prest 1987; Bjorck 1985; Dredge and Cowan 1989; Teller 1987; McAndrews *et al.* 1987). Figures 13.3 to 13.5 illustrate the general timing and configuration of deglaciation between about 10,000 and 7,000 B.P. The Big Trout Lake/ Wapekeka region was covered with glacial ice until some time after 8,400 years ago. After deglaciation it was likely immediately inundated by Lake Agassiz (Figure 13.4).

Between about 8,400 and 8,000 B.P., as the main mass of the Laurentide glacier rapidly disintegrated, Lake Agassiz abruptly drained into the Arctic Ocean, (Figure 13.4). As the disintegration of the Laurentide ice sheet occurred as part of a global phenomenon, there was a

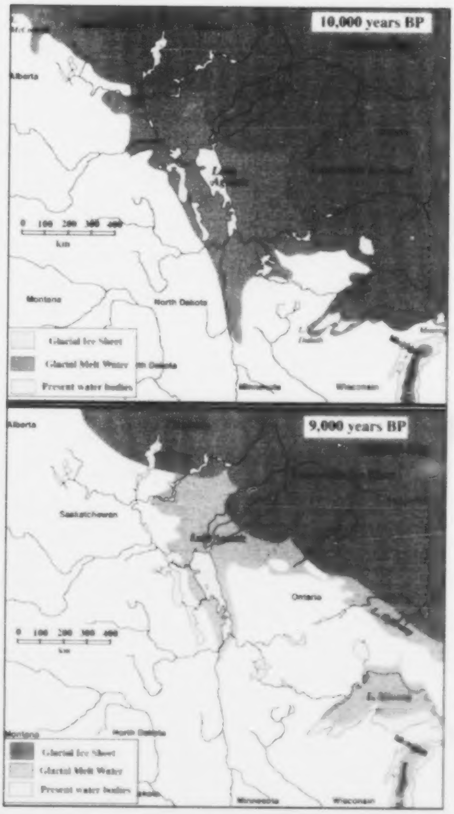

10,000 years BP
Alberta
0 100 200 300 400
km
Montana
North Dakota
Glacial Ice Sheet
Glacial Melt Water
Present water bodies
Minnesota
Wisconsin
9,000 years BP
Alberta
Saskatchewan
Ontario
0 100 200 300 400
km
Montana
North Dakota
Glacial Ice Sheet
Glacial Melt Water
Present water bodies
Minnesota
Wisconsin

Figure 13.3 Deglaciation at 10,000 and 9,000 years B.P.

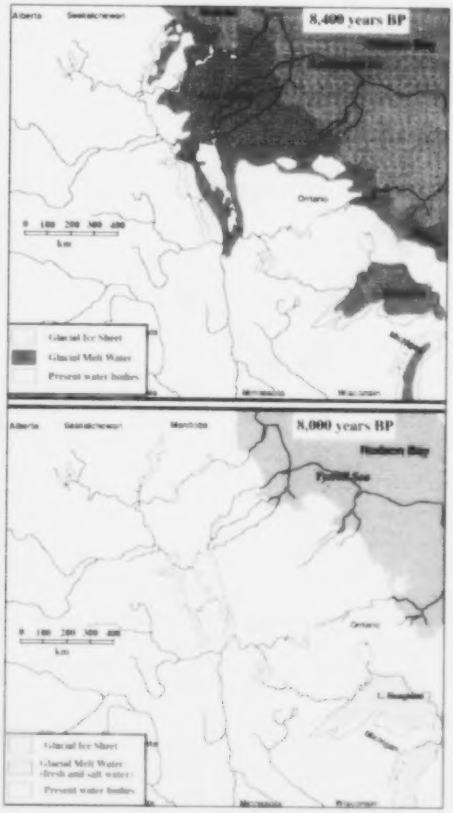

Alberta
Saskatchewan
8,400 years BP
Ontario
0 100 200 300 400
km
Glacial Ice Sheet
Glacial Melt Water
Present water bodies
Minnesota
Wisconsin
Alberta
Saskatchewan
Manitoba
8,000 years BP
Hudson Bay
Tyrrell Sea
Ontario
0 100 200 300 400
km
Glacial Ice Sheet
Glacial Melt Water (fresh and salt water)
Present water bodies
Minnesota
Wisconsin

Figure 13.4 Deglaciation at 8,400 and 8,000 years B.P.

dramatic net rise in the sea level. This resulted in extensive flooding of what is now the Hudson Bay Lowlands, forming the Tyrrell Sea (Figure 13.4). The maximum shoreline of the Tyrrell Sea is approximately 100 to 150 km north of Wapekeka (Figures 13.4 and 13.5) and much of the Hudson Bay Lowlands are mantled with marine sediments. Over the next several thousand years the Lowlands slowly emerged, with the present Hudson Bay shoreline not being achieved until some time after about 5,000 B.P.

Models of post-glacial vegetative recovery in the Lake Superior area have relevance for interpreting post-glacial recovery of the northern Severn River Uplands. Initial deglaciation of the Lake Superior basin occurred about 10,000 to 11,000 B.P. While large proglacial lakes formed along the ice front, a large peninsular lobe of upland extended northwards between Lake Agassiz, Lakes Duluth and Minong, and the Superior Ice Lobe (Figure 13.3). As deglaciation continued, this "peninsula," or "cul-de-sac" (Dawson 1983b) broadened and expanded northward. The general nature of vegetative recovery and succession in the south-

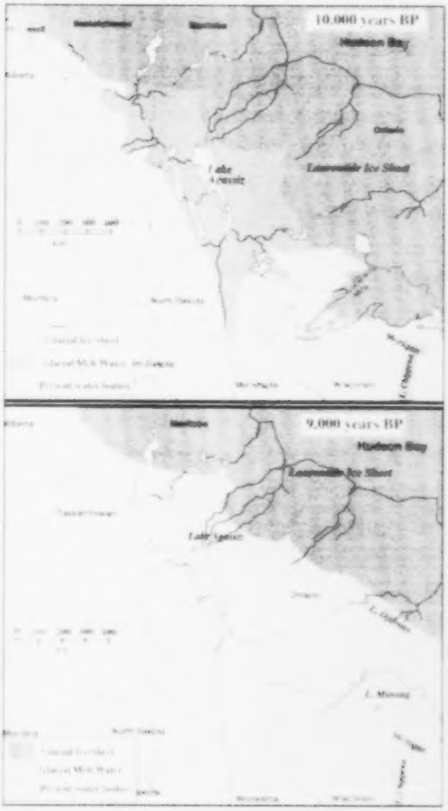

10,000 years BP
Hudson Bay
Ontario
Lake Agassiz
Laurentide Ice Sheet
9,000 years BP
Hudson Bay
Laurentide Ice Sheet
Lake Agassiz
L. Ojibway
L. Minong

Figure 13.3 Deglaciation at 10,000 and 9,000 years B.P.

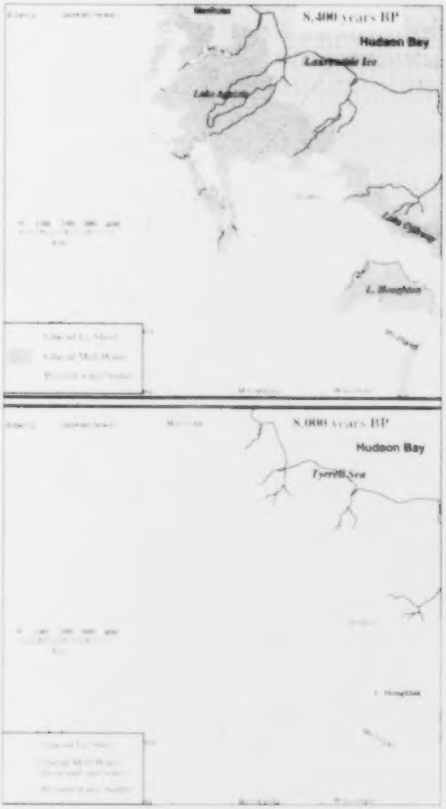

8,400 years BP
Hudson Bay
Laurentide Ice
Lake Agassiz
Lake Ojibway
L. Houghton
8,000 years BP
Hudson Bay
Tyrrell Sea

Figure 13.4 Deglaciation at 8,400 and 8,000 years B.P.

dramatic net rise in the sea level. This resulted in extensive flooding of what is now the Hudson Bay Lowlands, forming the Tyrrell Sea (Figure 13.4). The maximum shoreline of the Tyrrell Sea is approximately 100 to 150 km north of Wapekeka (Figures 13.4 and 13.5) and much of the Hudson Bay Lowlands are mantled with marine sediments. Over the next several thousand years the Lowlands slowly emerged, with the present Hudson Bay shoreline not being achieved until some time after about 5,000 B.P.

Models of post-glacial vegetative recovery in the Lake Superior area have relevance for interpreting post-glacial recovery of the northern Severn River Uplands. Initial deglaciation of the Lake Superior basin occurred about 10,000 to 11,000 B.P. While large proglacial lakes formed along the ice front, a large peninsular lobe of upland extended northwards between Lake Agassiz, Lakes Duluth and Minong, and the Superior Ice Lobe (Figure 13.3). As deglaciation continued, this "peninsula," or "cul-de-sac" (Dawson 1983b) broadened and expanded northward. The general nature of vegetative recovery and succession in the south-

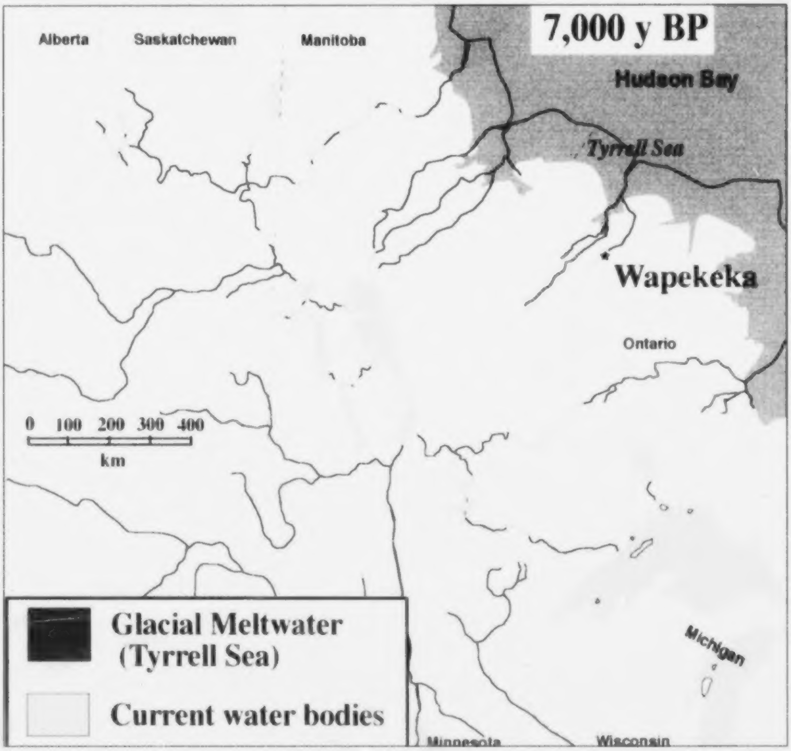

7,000 y BP
Alberta
Saskatchewan
Manitoba
Hudson Bay
Tyrrell Sea
Wapekeka
Ontario
0 100 200 300 400
km
Glacial Meltwater (Tyrrell Sea)
Current water bodies
Michigan
Minnesota
Wisconsin

Figure 13.5 Deglaciation at 7,000 years BP.

ern Boreal Forest is well documented through several pollen core studies (see McAndrews 1982; Julig *et al.* 1990; McAndrews *et al.* 1987).

In general terms, post-glacial vegetative recovery reflects McAndrews' (1982) pollen sequence that is divided into four phases. Initial colonization of recently deglaciated land defines the "Zone 1" phase, which is envisioned as open tundra, particularly on the uplands, with more diverse plant communities developing in sheltered locales and riparian zones (McAndrews 1982). This episode was comparatively brief in face of the rapid development of closed spruce forest (Pollen Zone 2). By as early as 9,200 B.P., continued climatic warming and soil development likely promoted such forest communities (Julig *et al.* 1990:39), and these habitats gradually "migrated" northwards as deglaciation proceeded. McAndrews' (1982) Pollen Zone 3 began about 8,000 B.P., and encompassed the Hypsithermal (warmer and drier) period that promoted more diverse forest communities during the mid-Holocene era. While evincing episodic fluctuations, Pollen Zone 3 vegetative conditions persisted until the contact period (Julig *et al.* 1990:39). Pollen Zone 4 coincides with modern climatic and vegetative conditions.

Given the steady pace of glacial retreat to the northeast after ca. 9,000 B.P., we should expect latitudinally oriented vegetation "clines" to the south of the glacial front (see McAndrews *et al.* 1987). In the area most immediately affected by glacial ice, a narrow band of arctic pioneer plants, lichen and woody shrubs developed. In areas more removed from the proglacial conditions, we can expect a transition to open coniferous forest and lichen lower storey vegetation. To the south of this transitional zone, the closed coniferous forest existed. As the ice front retreated to the northeast, there was a time-transgressive northerly movement of these vegetation communities and their resident animal populations. Since the Wapekeka region was free from ice and meltwater shortly after 8,000 B.P., it appears that about 1,000 years of vegetative recovery occurred prior to the inhumations at Wapekeka. It is assumed that coniferous lichen woodland (not unlike that presently found on the well-drained sand eskers) dominated the landscape at the time of interest. A consideration, yet to be explored, is the climatic affect of the Tyrrell Sea. Perhaps we should anticipate a "buffer" strip of arctic tundra along the exposed shores of the Tyrrell Sea, not unlike the tundra/forest buffer that currently exists along the Hudson Bay coast (Figure 13.1).

Local Topography and Landforms

The Wapekeka/Big Trout Lake region is comparatively flat and dominated by a network of north draining lakes, bogs and rivers (Figure 13.2). While not well represented on the current

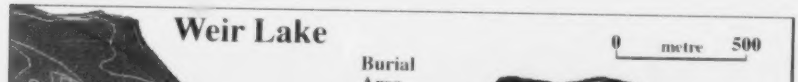


Figure 13.6 Topography of the Wapekeka Airstrip Area.

NTS topographic maps of the region, some areas exhibit sharp local relief and well-drained sediment. This variability contributes significantly to biotic diversity. Large sand ridges and knolls dominate the immediate Wapekeka region, and the most prominent is an irregular ridge that is intermittently represented on conventional topographic maps where high knolls exceed the 220 metre contour interval (Figure 13.2). Some of these sand ridges and knolls exhibit fine sedimentary bedding, suggesting that they are sand eskers, or remnants of small lakes that formed upon the glaciers.

Local relief is well documented on a large-scale topographic map produced by the Ontario Ministry of Transportation during the initial planning of the airstrip (Figure 13.6). The well-drained sand ridges primarily support conifer cover, with minimal lower storey vegetation. In the poorly drained areas, black spruce forest dominates with a much denser array of lower storey deciduous vegetation.

The detailed MTO topographic map reveals a series of localized ridges built along the north side of the sand esker, where it overlooks Weir Lake (Figure 13.6). These ridges are interpreted as beach strand lines formed by wave action along the north side of the sand esker. They are located between 40 and 220 metres inland from the present shoreline, and between two and five metres above the current level of Weir Lake. If these features formed part of an ancient shoreline, then they contained a lake that attained 215 metres asl (Figures 13.2 and 13.6). While the existing topographic maps do not plot this contour line, such a lake would have been very large, and it likely relates to the local deglaciation sequence (Figure 13.2). The effect of isostatic rebound upon these landscape features was likely considerable, but cannot be considered further here.

The Wapekeka burials are located directly upon the beach strand ridge overlooking Weir Lake (Figure 13.6). Since the formation of these beach features is not dated, their relationship to human occupation remains uncertain. Do the human skeletal remains represent human habitation and inhumation activities when the beach was still active or, after the water had declined to something approaching the current level of Weir Lake? This latter scenario does not explain the coincidence of the burials with the strand lines, rather than along the much larger and more extensive main esker ridge (Figure 13.6). Thus, it is at least plausible to propose that the burials reflect shoreline occupation during a time of considerably higher early Holocene water levels.

The Wapekeka Burial Excavations

Archaeological investigations in the spring of 1990 revealed that while no further land modification had occurred near the burial site itself, extensive earthmoving was done around the airstrip subsequent to the author's visit in the fall of 1989. Topographic high points had been graded away and sometimes up to 50 to 200 cm of surface sediment was removed. Many of the less disturbed surfaces were inspected, but no cultural material was observed (see Hamilton 1991b).

The burial recovery zone was the scene of most of the research. It is located upon the broadest part of the surviving sand beach ridge, about ten metres from the edge of the runway (Figures 13.6 and 13.7). This portion of the relict beach extends for about 200 metres

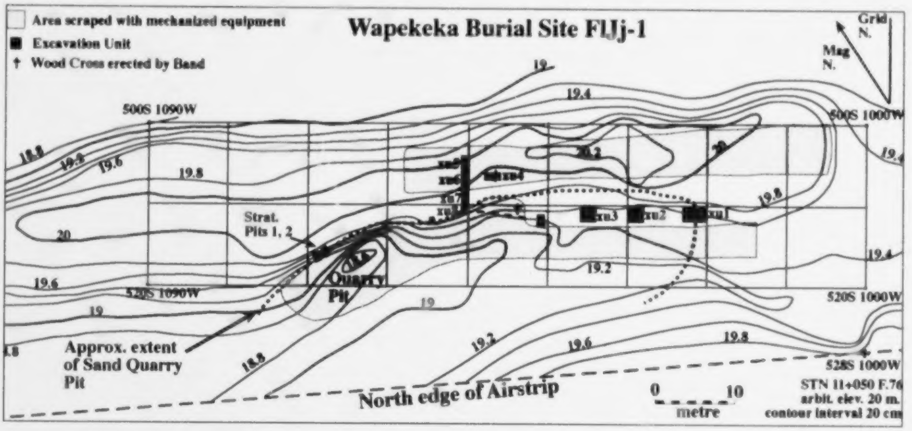

Area scraped with mechanized equipment
Excavation Unit
Wood Cross erected by Band
Wapekeka Burial Site FlJj-1
Grid N.
Mag N.
19
19.4
500S 1090W
500S 1000W
18.8
19.8
19.6
19.8
20.2
20
xu4
xu7
xu3
xu2
xu1
19.8
Strat. Pits 1, 2
20
19.4
19.2
19.6
520S 1090W
Quarry Pit
19
520S 1000W
19
Approx. extent of Sand Quarry Pit
18.8
19.2
19.6
19.8
528S 1000W
North edge of Airstrip
0
10
metre
STN 11+050 F.76
arbit. elev. 20 m.
contour interval 20 cm

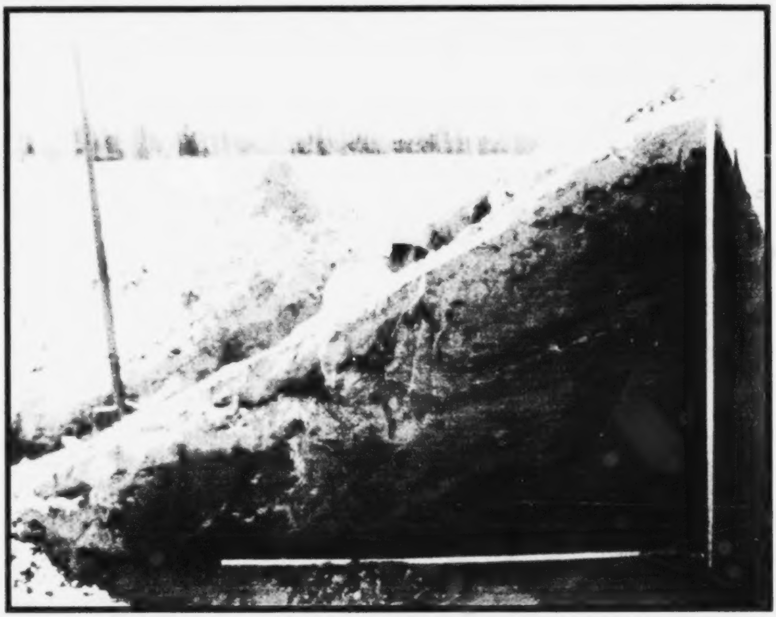
Figure 13.7 The Archaeological Investigations at the Wapekeka Burial Site.

along the north edge of the sand esker. It was severely damaged, with lower story vegetation, tree stumps, and weathered soil having been stripped with heavy equipment. Subsequent quarrying of the relict beach exposed the human remains and the Wapekeka Band marked the locality yielding the human remains with two wooden crosses (Figure 13.7). We were told that efforts to stabilize the burial site were limited to scraping sediment over the edge of the quarry to partially fill it. This suggested that the sand quarry was relatively small (perhaps 10 to 15 metres in diametre) and coincided with the depression noted as the "quarry pit" in Figure 13.7. Subsequent investigation proved this to be erroneous.

After a controlled surface collection, a topographic map of the beach ridge was produced. A grid system was established, using the airstrip survey stake "STN 11+050 F.76" as the primary datum (528S 1000W) (Figure 13.7). Since the original surface was already removed, the primary datum was arbitrarily assigned the elevation of 20 metres (Figure 13.7). A 20-cm contour interval map was constructed relative to this arbitrary elevation point (Figure 13.7).

Two vertical exposures were cut into the side of the quarry pit in order to define its edge and to determine the natural stratigraphic profile (Stratigraphy Pits 1 and 2) (Figure 13.7). Dramatic distinctions between undisturbed and disturbed sediments were observed that reflect both colour changes and truncation of the finely bedded sand (Figure 13.8).

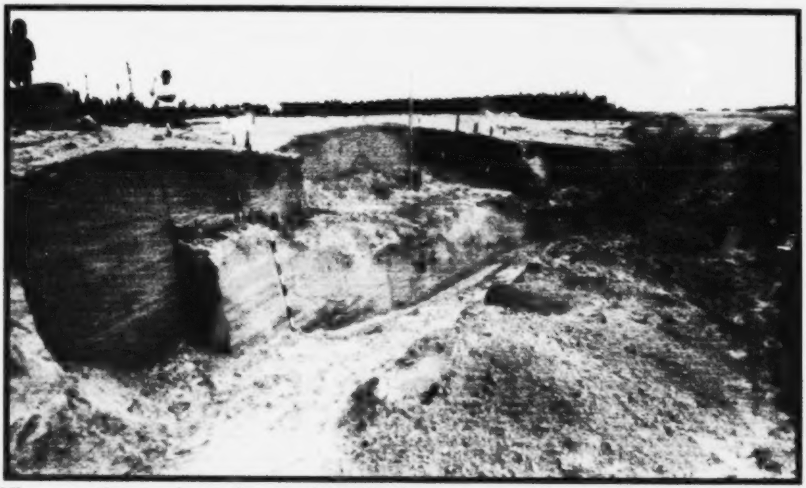
A proton magnetometer survey was conducted to search for undisturbed burial features. Analysis of the first six 100 m^2 blocks indicated that large magnetic disturbances underlie the area between the intact portion of the relict beach and the airstrip (Figure 13.7). These magnetic disturbances were much larger than expected of individual human burials and a 6-m^2 excavation pit (xu1) was dug to determine its origin (Figure 13.7). The sediment was "shovel shaved" and screened (nested .64 and .32 cm mesh) to search for small lithic and bone fragments. No cultural materials were recovered, and continued excavation revealed that the west half of XU1 truncated a large filled pit (Figures 13.7 and 13.8). This modern pit is the source of the magnetic disturbance, and it demonstrated that the quarry was much larger than first



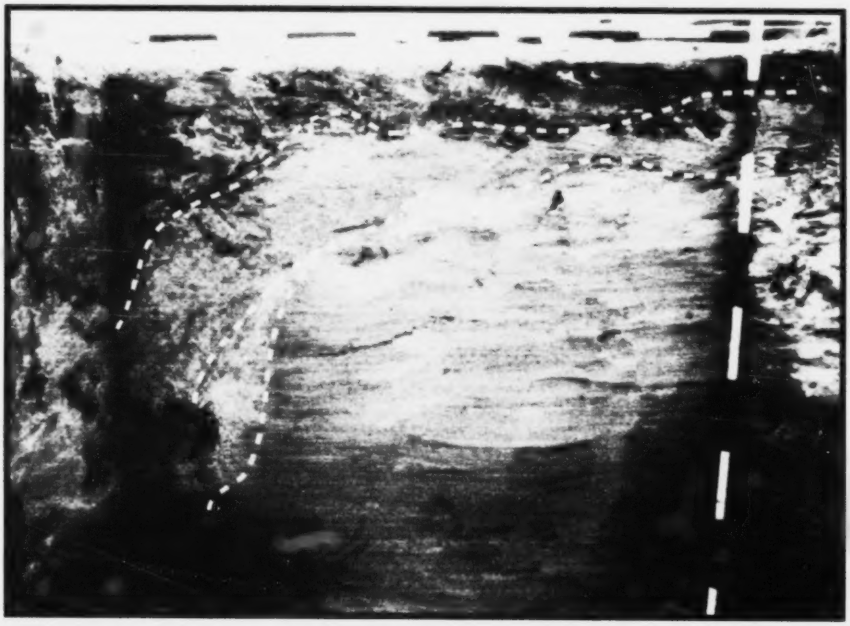
West wall of Strat. Pit 1 illustrating the quarry wall in cross-section.

North wall of Strat. Pit 1 illustrating bedded sands overlaid by disturbed sand and remnants of B horizon.

Figure 13.8 Exposed sediments in Strat. Pit 1.



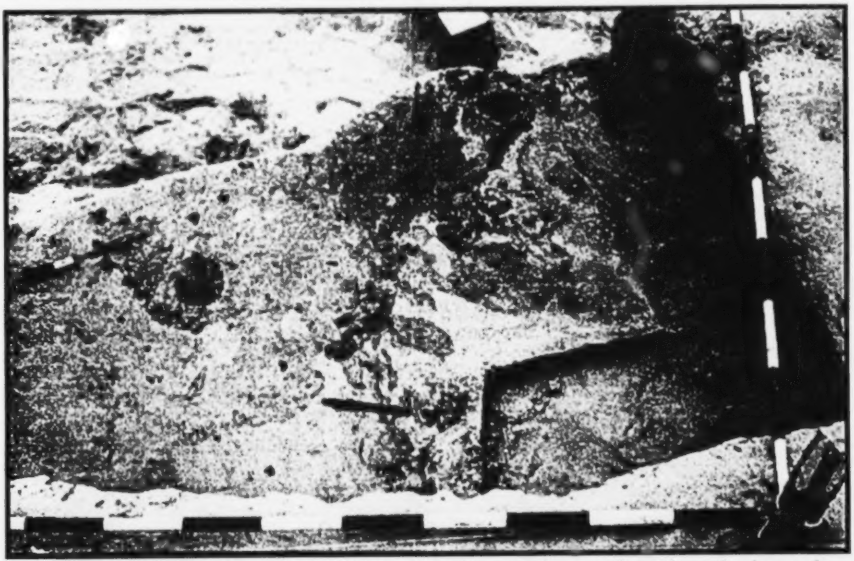
View northeast along the north wall of re-excavated quarry. Metre sticks mark approximate location of Burial Cluster A.



North wall of xu1 illustrating the east end of quarry. Dashed lines mark quarry fill.

Figure 13.9 Re-Exposure of the North Wall of Quarry.

Excavation of xu 8 to expose any remnant of the grave defining Burial Cluster A.



Only a very faint remnant of intact B horizon sediment, plus small patches of ochre and a few small bone fragments remain below the disturbed surface sand.

Figure 13.10 Excavation of Xu 8 to expose Burial Cluster A.

indicated. It extends over 45 metres east/west and at least 8 to 10 metres north/south (Figure 13.7). Two other 4 m^2 units were excavated to confirm this (XU 2 and 3) (Figure 13.7) and yielded disturbed sediment that is void of cultural material. Given the magnitude of these earthmoving activities and their intense magnetic profile, we abandoned the remote sensing survey.

At this point we focused on locating and salvaging the human remains from Burial Cluster A and B. Members of the MTO crew began removal of the fill that had been deposited in the quarry pit the previous year. A loader tractor was used to remove thin layers of sediment along an 8-metre wide strip from the proximity of XU 1, to the west end of the quarry pit near Strat. Pits 1 and 2 (Figure 13.7). After each successive pass the excavation crew monitored the trench, searching for artifacts and digging test pits to determine the proximity of undisturbed sand. During this monitoring we discovered a stone gouge in the disturbed fill; however, this was the only archaeological recovery.

This mechanized re-excavation continued until the trench was within one metre of the edge of the original quarry pit. The remaining disturbed sediment was removed by shovel in order to expose the original quarry wall. This was calculated to reveal the "burial cuts" containing remnants of the originally discovered skeletons. While we had been led to believe that these burials were encountered at some depth, no break in the bedded sands occurred from within ca 15 cm of the present surface down to about 2 metres in depth (Figures 13.8 and 13.9). The top 8- to 15-cm layer of sand was dried and mixed from pedestrian traffic and wind erosion. After re-exposing the quarry wall, an MTO worker who originally discovered the burials, pointed out the location of Burial Cluster A. Re-examination revealed a very faint mottled fill zone containing flecks of red ochre that extended only about 8 to 12 cm below the present surface. This faint evidence of the original grave cut was difficult to distinguish since it coincides with the contact between the bedded C horizon sands and the overlying mineral-stained and disturbed B horizon sediment (Figure 13.10).

The original discoverer of the burial also indicated that only one skeleton was encountered in Burial Cluster A, and not two, as had been suggested earlier by members of the Band Council. He also indicated that Burial Cluster B was represented by two (or perhaps three) skulls that had been discovered in loose sand pushed up by the bulldozer. It is not clear what skeletal material was subsequently collected and reburied in the community cemetery, and this confusion likely reflects the degree of site transformation, conflicting accounts of the burial discovery, and misunderstandings caused by language barriers.

A small excavation unit (xu8) was established to salvage any material still associated with the remaining grave cut. Only mottled patches of ochre stained sand, a human tooth, and one small cranial fragment were encountered. The human bone fragments were red ochre stained. No distinct grave cut was observed in cross-section or plan view, perhaps due to disturbance of the top 15 cm of sediment (Figure 13.10).

We next sought the original position of Burial Cluster B upon the beach ridge. A series of 1 by 2 metre test pits were excavated near the wooden crosses, but yielded no cultural material (Figure 13.7). The sand ridge was difficult to excavate since the surface sand was dried, unconsolidated, and had the consistency of sugar. The top 5 to 8 cm of sediment is severely disturbed by wind erosion and heavy pedestrian traffic. The colour distinctions that might mark burial cuts literally fade within minutes of exposure.

Given that very few bone fragments or lithics were noted on the sand surface of the beach ridge, a calculated risk was taken in locating the last known burials. As the sediment dried faster than we could expose a large horizontal area, mechanized equipment was used to expose an 8-metre wide strip along the top of the beach ridge (Figure 13.7). The MTO bulldozer removed thin strips of the dry unconsolidated sediment and exposed large areas of damp, undisturbed, bedded sands. It was hoped that grave cuts would stand in contrast to the bedded sands making up the C-Horizon. We removed a total of 15 to 30 cm of disturbed sediment in successive passes down the 25-metre long strip (Figure 13.7). This undisturbed sediment was then lightly "shovel shaved" to remove loose sand, and the exposed damp sand was then troweled smooth to expose any potential burial cuts. Between 20 and 25 elliptical, round or irregular mottled patches of sand were encountered, marked, and cross-sectioned by trowel to determine their extent and contents. They were all shallow, culturally sterile patches of stained sediment that ranged in depth between 3 and 15 cm. These shallow pits were likely created when wind-toppled trees displaced sediment.

The archaeological investigations failed to locate intact archaeological materials from either of the two burial clusters. While a few human bone fragments were recovered from Burial Cluster A and from the site surface near the crosses, no undisturbed human remains were discovered. Without examination of the remains interred in the community cemetery it cannot be determined whether all of the skeleton(s) are accounted for. Archaeological investigation of the surviving beach ridge encompassed approximately 75% of its extent, and represents an even higher proportion of the undisturbed part of the site. No bone fragments were encountered and, with the exception of the ground stone gouge (to be discussed below), no artifacts were recovered. Stabilization of the burial area was completed by the MTO shortly after completion of the 1990 archaeological fieldwork (Cam Brown, personal communication 1990).

The Archaeological Recoveries

Human Skeletal Remains

Despite the degree of site damage, a small portion of between 3 to 5 human skeletons was available for analysis. Most of the skeletal material had been discovered, collected, and reburied in the community cemetery long before archaeologists visited the site. Most of the available fragments have a red surface stain. On exposed surfaces this stain is barely perceptible but is quite readily apparent within cavities and on protected surfaces. A sample was examined using a scanning electron microscope, and an elemental analysis yielded a high concentration of iron that is consistent with iron compounds found in red ochre. There is a long and very widespread cultural tradition of human burial treatment using red ochre that dates back to Archaic and perhaps Palaeo-Indian times (see Jenks 1937; Mason 1981). The use of this compound in the Wapekeka burials provides further evidence of the great antiquity and widespread nature of the practice.

Given the limited amount of skeletal material available for analysis, there is comparatively limited insight possible. Dr. El Molto of Lakehead University conducted the analysis and arranged for initial chemical analyses by Drs. Scott Fairgrieve and Brenda Kennedy at the

Universities of Toronto and Calgary, respectively. Dr Molto's analysis was included in the license report (Hamilton 1991b), and is briefly summarized here.

BURIAL BLUSTER B

Specimen FlJj-1-1: A fragment of a right temporal bone.

Specimen FlJj-1-4: An isolated first mandibular molar that likely belongs with specimen Flj-1–2 (Figure 13.11). The tooth is well preserved although the enamel is cracking due to post mortem dryness. The only evidence of pathology is a well-delineated circumferential hypoplastic line that occurs 2.1 mm from the CEJ (Figure 13.11). Using data on the development of the first molar, it appears that some "insult" occurred between two and three years

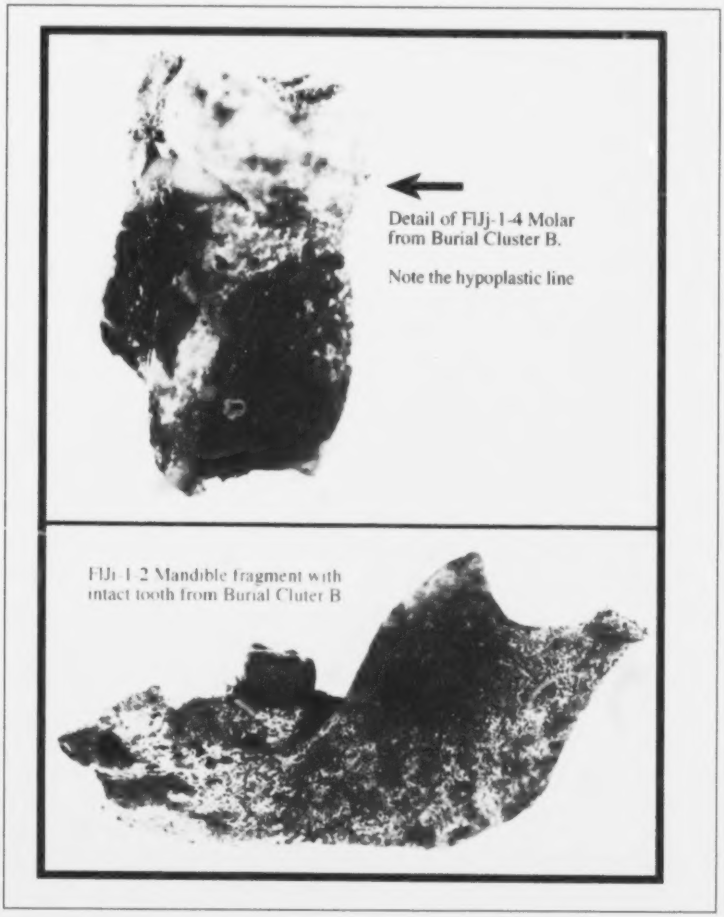

Detail of FlJj-1-4 Molar
from Burial Cluster B.
Note the hypoplastic line
FlJj-1-2 Mandible fragment with
intact tooth from Burial Cluter B

Figure 13.11 Mandibular molar and mandible section from Burial Cluster B.

of age. The line measures 1.6 mm and is unusually deep into the enamel structure, suggesting a prolonged disorder that inflicted considerable morbidity to the individual.

Specimen FlJj-1-2: A portion of a left mandible preserved from the alveolus of PM2 to the posterior ramus (Figure 13.11). The second molar is in place and fully erupted, and the third molar crown appears to be developed but has not started the eruption process. The dental age is estimated at 13 to 15 ± 2.5 years. The second molar is healthy (no caries, calculus, hypoplasia, or antemortem trauma).

Specimen FlJj-1-3: The fragment is a small section of cranium, likely from one of the parietals or the occiput.

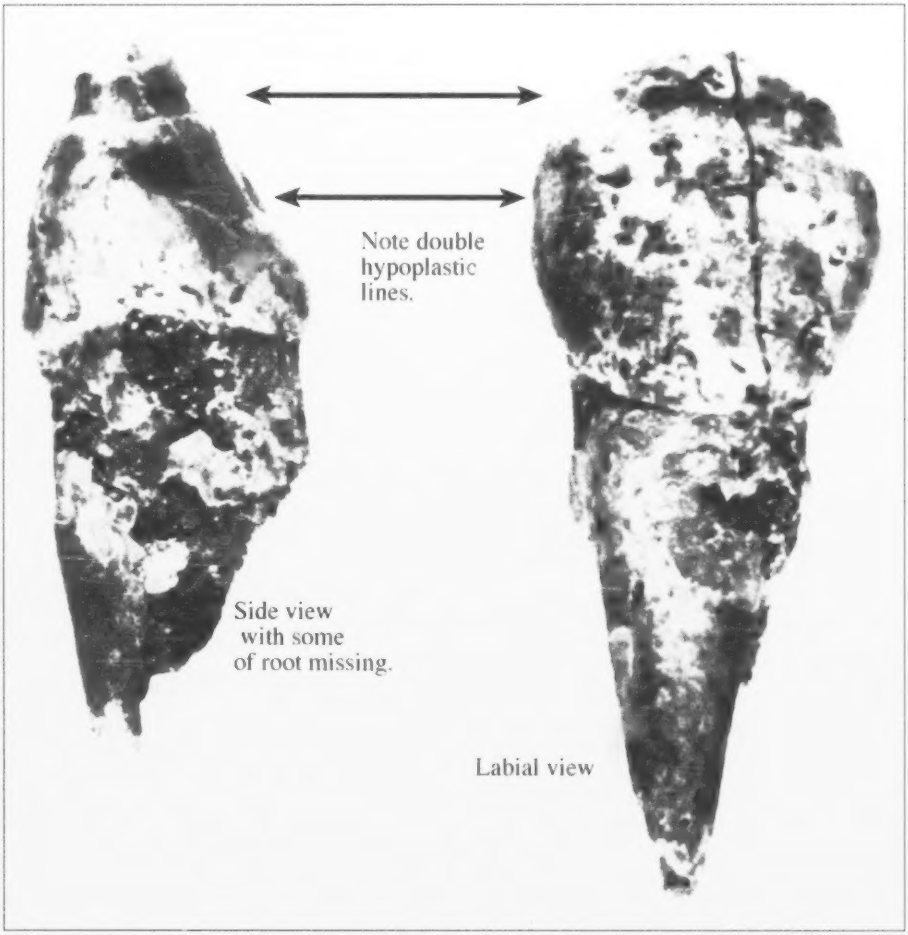


Figure 13.12 Maxillary Canine tooth from Burial Cluster A (FlJj-1 xu8-1-1).

Specimen FlJj-1-10: A partially developed crown of a maxillary right 2nd premolar. As this tooth had not erupted, extrinsic dental pathology is absent. There is also no evidence of dental hypoplasia. Following Ubelaker (1978), the dental age estimate from this isolated specimen is 4 to 6 years.

BURIAL CLUSTER A

Specimen FlJj-1 XU 8-2-1: A fragment of the right anterior clinoid region. It is not possible to determine the individual's gender, although the stage of clinoid development indicates a subadult individual.

Specimen FlJj-1 XU 8-1-1: Five small (and healthy) unidentifiable fragments of compact bone, plus a well-preserved tooth. Small clumps of red ochre are mixed in the sand fill.

The tooth is a permanent maxillary left canine that is intact except for the tip and posterior border of the root (Figure 13.12). All surfaces, particularly the labial, have evidence of red ochre. Macroscopic and SEM analysis reveal very slight enamel polishing, indicating that the tooth had limited masticatory use. However, it must be emphasized that the apex of the maxillary canine is quite variable and that a blunted crown is a common morphological feature. In Amerindians the permanent maxillary canines usually erupt by 12 ± 2.5 years (Ubelaker 1978). This individual likely falls within this age range.

The apex of the crown is blunt, and the mesial and distal shoulders slope gradually with no apparent "style" development. On the lingual surface a small tubercle (cingulum) is present and the mesial and distal marginal ridges are well demarcated giving a shovelled appearance.

As expected of a newly erupted tooth, there is no evidence of extrinsic dental pathology. However, enamel hypoplasias are present on both the labial and lingual surfaces. The first, which is circumferential, is a deeply grooved line that measures 1.3 mm commencing approximately 2.9 mm from the apex (Figure 13.12). It is not possible to measure the depth of the groove but it is clearly visible to the eye without the aid of magnification. The second hypoplastic line is a small but distinct linear striation that is more visible on the labial than on the lingual surface. It is located approximately 4.0 mm from the CEJ and 7.1 mm from the apex. These enamel hypoplasias, particularly the former, indicate severe physiological stress in this person's early childhood, almost certainly between two and four years of age (see Ubelaker 1978). Given the palaeoenvironmental circumstances, it is probable that the cause of the stress was nutritional with concomitant synergistic infections of the gastric intestinal system. Given the size and circumferential nature of the defect, the stress producing the hypoplasia was considerable and chronic, possibly lasting up to a year.

Specimen FlJj-1 XU 8-1-2: This fragment was used for collagen extraction and isotopic analysis, and has been consumed as part of the analytical process. It was a highly leached endocranial fragment, likely from a left parietal.

Surface Collected Human Bones: The first of two samples consists of at least 25 pieces of unidentifiable bone fragments, a distal hand phalanx, and two small enamel fragments, likely from a right central maxillary incisor. Many of the bone fragments have been treated with red ochre. The poor state of preservation precludes any detailed analysis. The tooth fragments show a very well-defined marginal enamel ridge, indicative of moderate to advanced development of "shovelling," which is a well known characteristic of Amerindian incisors. It is not possible to tell if the tooth had erupted. The second surface sample consists of 14 weathered cortical bone fragments. Only two are possibly identifiable. One of these is a portion of a diaphysis of a metatarsal or metacarpal, the other is likely a fragment of the greater sphenoidal wing.

SUMMARY: The bone sample from Burial Cluster B was used to generate all three radiocarbon dates and represents fragments from at least two individuals. The mandibular fragments indicate that the first individual was between 13 to 15 ± 2.5 years old at time of death. The second individual is represented by the unerupted premolar, and was likely between 4 and 6 years of age at the time of death. Within Burial Cluster A, a third individual is represented and, based upon the permanent canine tooth, was likely about 12 ± 2.5 years old at the time of death. The young age at mortality of all three individuals is noteworthy.

The most dramatic dental characteristic is observed on specimens FlJi-1-4 and FlJj-1 XU 8-1-1. These teeth are from two different individuals; one each from burial clusters A and B. Both specimens show very distinctive enamel hypoplastic lines that reflect an interruption in the development of the enamel prior to the eruption of the tooth. This generally comes about from severe and prolonged illness or nutritional deprivation. Drs. Molto and Fairgrieve agree that the degree of hypoplasia is considerable and represents some of the most severe cases that they have examined.

The evidence of hypoplasia on two of the three individuals makes it clear that severe and sustained physical stress figured prominently in the lives of these people. Perhaps this came about from severe food shortages that affected the entire population or, children who were particularly vulnerable during weaning. The regularity of this stress cannot be measured since it appears in the teeth only when it coincides with tooth formation. The individual, who was recovered from Burial Cluster A, sustained two such severe episodes in his/her childhood; therefore, we can assume that this stress was chronic and that it likely reflects nutritional causes. Clearly, we must critically assess the relative effectiveness of northern early Holocene subsistence practices.

The Radiocarbon Dates

Three samples of human bone from Burial Cluster B were submitted to the IsoTrace Radiocarbon Lab at the University of Toronto. These samples yielded radiocarbon dates of 6,630 ±90 B.P. (TO-1943), 6,800 ±90 B.P. (TO-1941), and 7,080 ±90 B.P. (TO-1942) (Table 13.1). The calibrations of these dates are also included in Table 13.1. These dates are astonishingly old when considering northern Ontario cultural history and the implications of this antiquity will be addressed more fully in the concluding section of this paper.

Isotopic Analysis of Human Bones

Stable isotope analysis of the Wapekeka sample was initially conducted at the University of Waterloo. The ^{13}C values of -18.92‰, -18.9‰ and -18.33‰ were acquired (Table 13.1). Subsequent re-testing of two of these bones by Theresa Schrober (University of Florida) yield-

Table 13.1 Wapekeka Radiocarbon Dates with Calibration Results.

Lab #	14C age B.P.	sd	Calib. Age B.P.	Method A Range		Method B Range			
				1 sigma	2 sigma	1 sigma	p	2 sigma	p
TO 1941	6800	90	7660	7685 to 7573	7790 to 7554	7721 to 7707	0.06	7820 to 7807	0.01
			7627		7541 to 7506	7700 to 7570	**0.94**	7792 to 7545	**0.90**
			7621		7495 to 7492			7544 to 7478	0.09
TO 1942	7080	90	7933	7968 to 7790	8108 to 8091	7967 to 7816	**0.89**	8107 to 8092	0.02
			7893		8034 to 7684	7812 to 7791	0.11	8032 to 7691	**0.98**
			7873						
TO 1943	6630	90	7558	7583 to 7429	7666 to 7416	7571 to 7457	**0.87**	7667 to 7416	**0.96**
			7538		7390 to 7370	7451 to 7432	0.12	7391 to 7369	0.02
			7507		7349 to 7335			7349 to 7334	0.02

ed results that deviate only slightly. These ^{13}C values are more enriched than expected for Subarctic Canada and have stimulated an ongoing study of the Subarctic food web and human subsistence. These data will be addressed briefly but substantive discussion must await publication of the research currently under way.

Stable carbon and nitrogen isotope analysis seeks to measure the relative importance of general food categories in the diet of the individual or population under study. Such research has been used in North America to differentiate between terrestrial and marine exploitation. It has also been used to determine the degree to which maize, a domesticated C4 plant, was integrated into the pre-Columbian human diet (see Chisholm *et al.* 1982, 1986; van der Merwe and Vogel 1978; and Ambrose 1987). Given the limited extent of such research in Subarctic Canada, it was initially assumed that stable carbon isotope values would be quite low, consistent with the predominance of C3 plants in northern North America. The values expected from populations relying heavily upon terrestrial animals consuming C3 plants range from -33 to -22 ‰ (average -27 ‰), while values from organisms with C4 plants (including

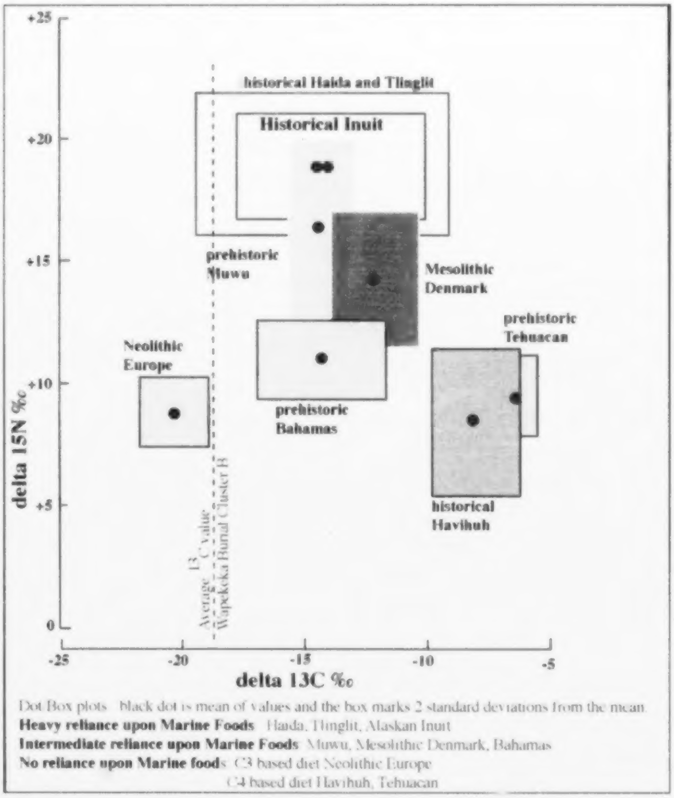


Figure 13.13 Stable Isotope Values from a Series of Human Skeletal Populations that Illustrate General Distinctions between C3, C4 and Marine Diets.

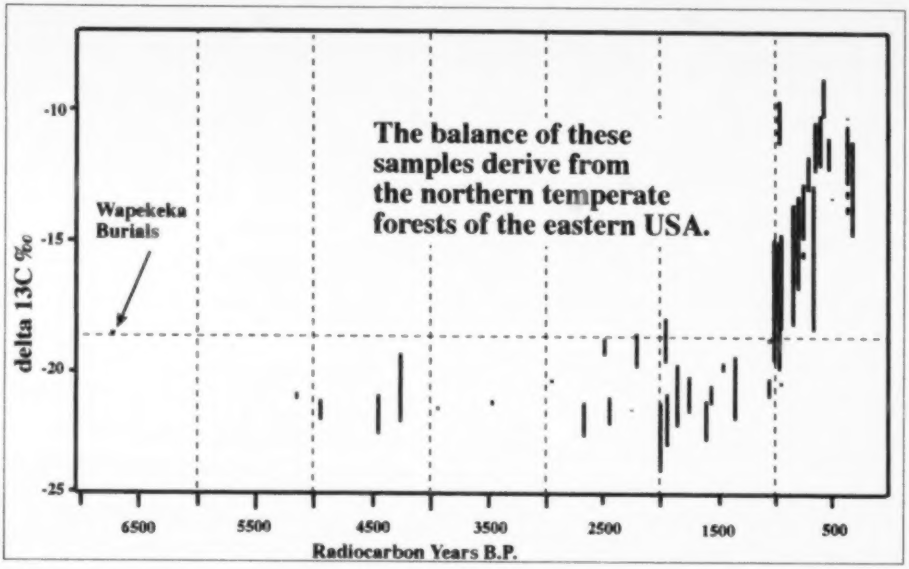


Figure 13.14 Change in Delta ^{13}C Values in Human Bone through Time.

maize) at the base of the food chain range from -16 ‰ to -9 ‰ (average -12.5 ‰) (De Niro 1987:183). Marine oriented diets produce values that fall intermediate between these ranges, and generally vary between -19‰ and -8 ‰ (De Niro 1987:187). The Wapekeka data yield delta ^{13}C values that are tightly clustered around an average of -18.7 ‰. This coincides approximately with the "upper" range of that expected of humans in terrestrial C3 plant-dominated habitats, and at the "lower" range of that of marine-based subsistence (Figure 13.13). The significance of the Wapekeka delta ^{13}C values are dramatically apparent in Figure 13.14 that plots radiocarbon dates against average delta ^{13}C values (Ambrose 1987). These values were originally presented by Ambrose (1987) to document the shift through time from a terrestrial hunting and gathering economy to one based upon corn horticulture in the Eastern Woodlands of North America. When the values from Wapekeka are included in Figure 13.14, it is apparent that these comparatively ancient bones have ^{13}C values that are inconsistent with the Archaic and Early/Middle Woodland samples from northern temperate environments.

Clearly, some dietary component of the Wapekeka population is unexpectedly contributing to ^{13}C enrichment. The possibility that lab error might be causing these unexpected results was addressed and dismissed with Schrober's re-testing. The antiquity and geographic location of the human remains precluded any realistic consideration of C4 plants forming an important part of the diet. In the early 1990s there was no comparative data to interpret these values, nor did we have the critical ^{15}N isotope values to aid in assessing the nutritional importance of aquatic resources.

To develop the necessary comparative database, a study is under way in collaboration with Theresa Schrober (University of Florida) and Monica Webster (University of Calgary). This study cannot be addressed here other than to correct speculations offered earlier by Hamilton (1991a, 1991b) and cited by Wright (1995:125–126). At that time it was proposed that the ^{13}C enrichment might be a function of marine resource exploitation (fish or sea mammals) from the nearby Tyrrell Sea. To date we have collected and analyzed ^{13}C and ^{15}N values from a small assemblage of Boreal Forest human skeletal remains dating throughout the Holocene period, plus animal and plant samples also deriving from the Subarctic. The human samples exhibit ^{13}C values that range from -18.24 ‰ through to -20.58 ‰, and ^{15}N values that range from +10.46‰ to +12.82‰. The ^{15}N values are not consistent with those deriving from human populations who relied heavily upon marine resources (De Niro 1987) (Figure 13.13), and they negate earlier speculation regarding the importance of Tyrrell Sea marine resources. Interestingly, unexpectedly high ^{13}C values are found in all of the Subarctic human samples that are presently available for analysis. Clearly, a much more comprehen-

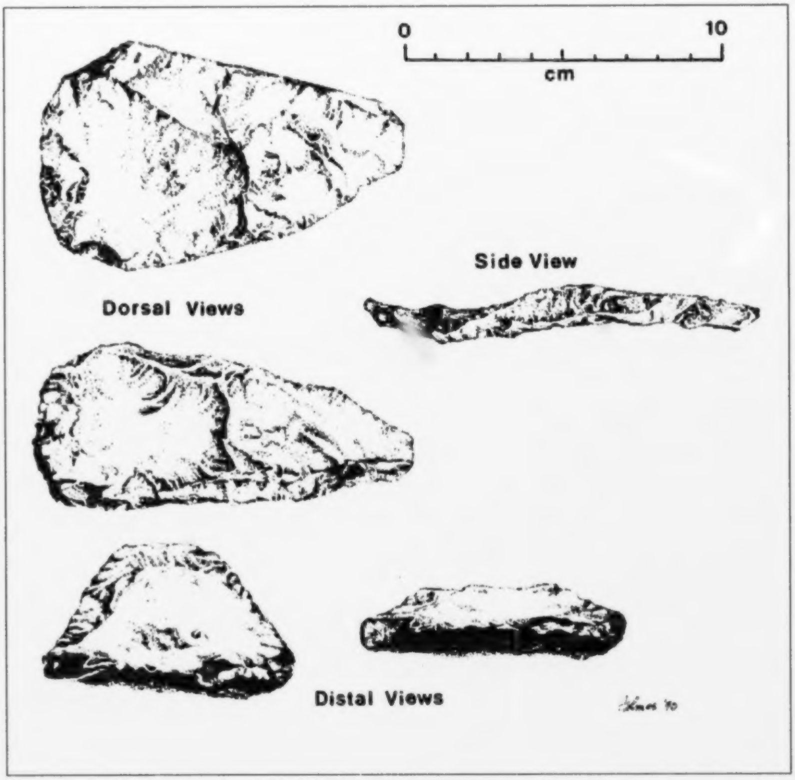


Figure 13.15 Chitho That May Have Been Associated with Burial Cluster A.

sive examination of the Subarctic food web is required to identify the source of this systemic fractionation phenomenon. This latter phase of the study is under way.

Lithic Materials

Two stone tools were recovered in a disturbed context. It cannot be determined whether they were originally associated with the human burials, or if they derive from some later occupation that was destroyed and removed during airstrip construction.

Possible "Chitho"

Members of the Wapekeka First Nation recovered this crudely flaked triangular object when Burial Cluster A was discovered in the fall of 1988 (Figure 13.15). It is composed of a coarse textured dark red/brown mudstone and is faintly stained with irregular patches of dark red pigment, perhaps ochre. The staining was too faint to warrant SEM examination, particularly since we could not readily distinguish between scrapings of the stain versus the mineral structure of the stone object. If, indeed, it was a burial inclusion, then the red stain is likely red ochre.

The tool was produced from a stone spall, with only the left lateral edge exhibiting the original weathered cortical surface. The remaining surfaces of the tool are irregularly flaked. Some distinct flake scars are apparent on both the dorsal and ventral surfaces, but the coarse texture of the stone results in predominantly sub-concoidal flakes. The only clearly bifacally flaked surface is the broad distal end (Figure 13.15). Only about 2/3 of this distal end shows a bifacially thinned edge, while the remaining 1/3 is unthinned and about 4 mm broad. Even the thinned portion of the distal end is crudely executed and individual flakes abruptly end in hinge fractures.

This item does not appear to have been used as a conventional cutting and piercing tool. Rather, it is interpreted as a "Chitho." These items are generally quite crude in appearance and are composed of coarse-grained materials. Chithos are thought to be rough hide scraping tools and have little temporal diagnostic value other than making their first appearance in Archaic assemblages.

Ground Stone Gouge

In 1990, the archaeological crew recovered a large ground stone gouge from disturbed sediment that had been re-deposited into the quarry pit. The gouge is composed of a relatively soft red mudstone and weighs 896 grams. It shows damage that likely came about from use as a heavy gouging tool, perhaps for woodworking. One bit end is intact, but a longitudinal transverse fracture has resulted in the loss of about one third of the specimen (Figure 13.16). The remaining tool portion is approximately 27.5 cm long, 5.27 cm wide and 5.2 cm tall (Figure 13.16). The distal bit end exhibits a great deal of battering, which has rounded and blunted it (Figure 13.16). Bipolar battering probably caused the transverse fracture at the proximal end, and the fractured end exhibits damage that suggests continued use after the transverse fracture occurred.

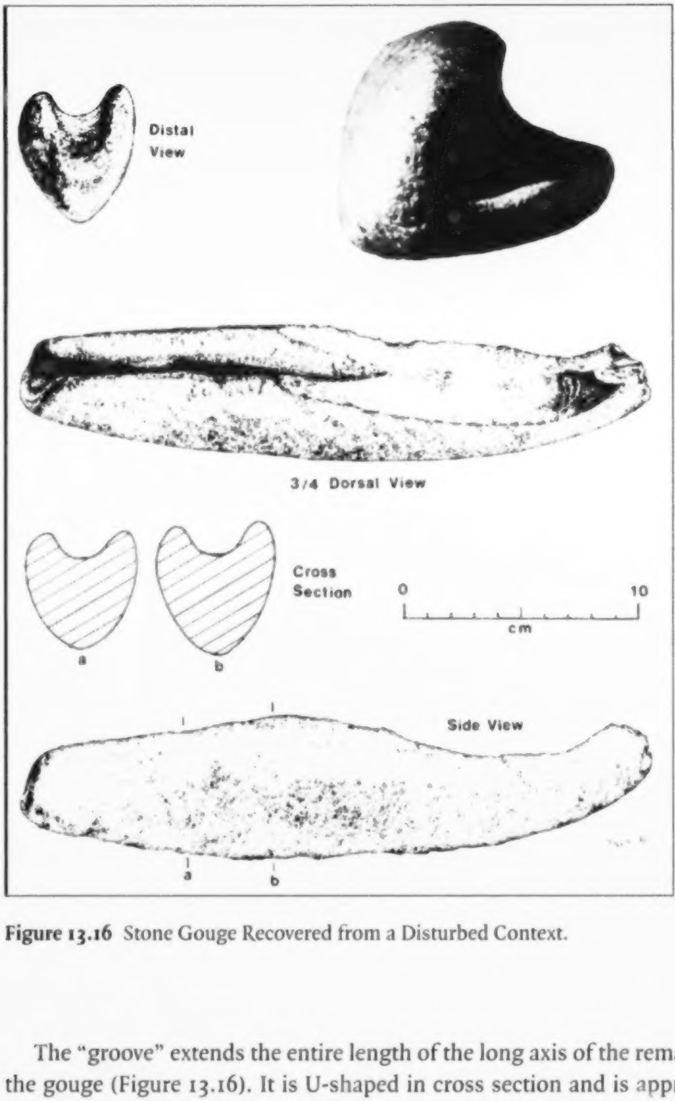


Figure 13.16 Stone Gouge Recovered from a Disturbed Context.

The "groove" extends the entire length of the long axis of the remaining dorsal surface of the gouge (Figure 13.16). It is U-shaped in cross section and is approximately 2.5 cm wide and about 1 cm deep. Some longitudinal abrasion is apparent within the groove, indicating that it likely was produced by a combination of pecking and grinding. While clearly a gouge, it differs from most illustrations reviewed in the literature. Most notable is the relative "narrowness" of the central groove, the thickness of the lateral flanges on each side of the groove, and the degree of battering of the bit end (Figure 13.16).

The ventral and lateral surfaces of the gouge are pock marked, perhaps indicating the mode of manufacture by repeated pecking. Gouges illustrated in the pertinent archaeological literature are carefully smoothed and polished in sharp contrast to the unrefined surface finish of the Wapekeka example (see Willey 1962; Tuck 1977, 1978). The cross section of the gouge at various points is not perfectly symmetrical, but the ventral keel deviates only slightly from the midline of the object (Figure 13.16). This near-perfect symmetry indicates quite a sophisticated production technology that runs counter to the rather rough surface "finish." While stone gouges have been found in northern Ontario, they are not common and are, in fact, quite rare in northwestern Ontario. One, and perhaps two, gouges are reported in private collections from the Lac Seul region ("Paddy" Reid, personal communication 1991). J.V. Wright (personal communication 1991; 1995:125) notes that while not a common occurrence, gouges are occasionally found throughout northern Québec (Laliberté 1978) and Ontario (Wright 1972a), southeastern Manitoba (Buchner 1982) and Minnesota (Johnson 1969).

Gouges are generally considered to be diagnostic of Laurentian Archaic and Maritime Archaic assemblages (Wright 1972a; Mason 1981; Willey 1962). Wright (1972a:78) maintains that some gouges and other Laurentian Archaic-like materials are occasionally found associated with Shield Archaic assemblages, but they are more commonly found in the Boreal Forest/Great Lakes St. Lawrence Forest interface (in the area surrounding Lake Huron and Georgian Bay). He also comments that the Wapekeka gouge may reflect exchange relationships between early Shield Archaic populations and contemporaneous Maritime and Laurentian Archaic populations far to the east (1995:125). This suggests significant extra-regional connections between early and middle Holocene human populations. Wright (1995:125) also comments that the early appearance of "full-grooved" gouges in Maritime and Great Lakes-St. Lawrence cultures makes it at least possible that the Wapekeka specimen might have been associated with the dated burials. Given the rather limited extent of archaeological investigation in northern Ontario, particularly in the far north, the relative absence of ground stone technology may well be more apparent than real.

Conclusions

The limited archaeological recoveries and their disturbed context severely constrain the interpretations possible of the Wapekeka Burial Site. However, the absolute age of the skeletal material (and the stone gouge) make the site important for refining our current understanding of the early human history of northern Ontario.

It is particularly noteworthy that the site has yielded at least three individuals buried upon the relict beach. The bodies of the three young people appear to have been treated with red ochre, and there may have been an offering included with at least one (the chitho believed to have been recovered from Burial Cluster A). The multiple graves might suggest a catastrophic event whereby several members of a community died simultaneously and were buried in the same place. Alternatively, the site might be interpreted as a repeatedly used place for interring the dead. The latter scenario implies that the early Holocene occupants were well established in the northern Severn Uplands and, while they were mobile foragers, may have returned to special places to bury their dead. Given the temporal clustering of these dates, both calibrated and uncalibrated, either alternative is possible (Figure 13.17). However, the temporal overlap is weak and apparent only at the two sigma level. This is more supportive of the notion that the burials represent sequential events rather than a single catastrophic one.

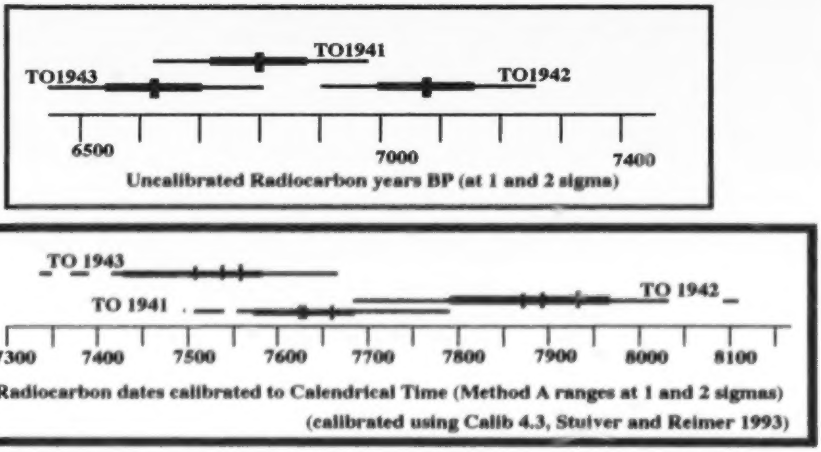


Figure 17 Temporal Overlap (at 2 sigmas) of Wapekeka Radiocarbon Dates

Figure 13.17 Temporal Overlap (at 2 sigmas) of Wapekeka Radiocarbon Dates.

The observation of severe hypoplasia on the teeth of two of the three individuals suggests that either periodic starvation or chronic illness figured prominently in the lives of these children. Given the minimal archaeological recoveries, we can do little more than speculate about the economy of these early Holocene people. Perhaps the ongoing stable isotope research will aid in interpreting the subsistence economy in relation to later, better known, archaeological cultures.

Wapekeka also contributes to models of the initial human occupation of far northern Ontario. Late Palaeo-Indian northward migration in face of deglaciation is a widespread phenomenon. Along the southern and western margins of the Canadian Shield, this occurred relatively late in the Palaeo-Indian period (Buchner and Pettipas 1990). In northwestern Ontario, Plano is best known with the Lakehead Complex (Fox 1975, 1980), and is provisionally dated to some point after Lake Minong shoreline formation between 10,000 and 9,700 B.P. (Mason 1981:125) (see also Ross 1995). A more conservative estimate of the temporal duration of the Lakehead Complex (or more specifically the occupation of the Cummins site) ranges between 9,600 to 7,500 B.P. (Julig *et al.* 1990 citing Dawson 1983a). The only Lakehead Complex radiocarbon date is 8,480 ±390 B.P. (NMC 1216), based upon fragments of a cremated human burial from the Cummins Site (Julig *et al.* 1990). These Plano archaeological sites probably reflect the northward movement of people in pursuit of animals adapted to the Subarctic and tundra edge. Plano hunters likely ranged widely over the upland peninsula between the glacial lakes. This is evident with the recovery of late Palaeo-Indian materials in the Shabaqua highlands at the Kozak Site (Stewart, personal communication 1990); at Dog Lake and Whitefish Lake (McLeod 1978, 1980, 1982); in the Rainy River region (Reid

1980:33–36; Haywood 1989); throughout the Kaministiquia River delta (Hamilton 1996); and, perhaps within the Black Sturgeon River region (Hamilton nd; Bill Ross, personal communication 1998). Recent discoveries by Pilon and Dalla Bona, of archaeological materials associated with an early Holocene paleosol at the Allen Site (see Pilon and Dalla Bona, this volume), is also informative of the early presence of humans in the region.

At approximately the same time that the southern Severn Uplands between glacial Lakes Agassiz and Minong were being occupied by Plano people, similar developments were occurring throughout what is now northern Alberta, Saskatchewan, Manitoba and the adjacent parts of Nunavut and the North West Territories (Wright 1981:87; Noble 1981:97–98). These sites yield projectile point assemblages reminiscent of late Plano culture. Some of these deposits have been radiocarbon dated to about 5,000 years BC (Acasta Site), and 6,770 ±190 B.C. (GaK-1275) at Fisherman Lake (Noble 1981:98). These Plano groups are interpreted as engaging in a mix of caribou hunting and fishing at the interface between the northern forest and the tundra (Wright 1995:111–112).

Northern Plano technology appears to persist long after its disappearance in the midcontinental grasslands. J.V. Wright (1981) has interpreted this "technological conservatism" or persistence, as a hallmark of Northern Plano, and believes it was also an important feature of Shield Archaic. He proposes that over several thousand years Northern Plano persisted, but that it gradually evolved into a more diversified Shield Archaic economy and technology, presumably as an adaptation to the post-glacial development of the northern forests. On several occasions, Wright (1972a:69; 1976:91–93; 1995:99) has tentatively proposed that Shield Archaic origins derive from the Northern Plano groups. As deglaciation, glacial lake drainage, and re-vegetation proceeded, these groups expanded southeastward around the Hudson Bay basin, to sparsely occupy the greater part of the Canadian Shield (see also Wright and Vincent 1987). This incompletely understood culture is viewed as a migratory hunting and gathering society that adopted a flexible subsistence and settlement pattern, which was ideally suited to the comparatively sparse and patchy resource base of the Boreal Forest (see Dawson 1983b:59–66).

At much the same time that such transitions were occurring in the far north, similar technological change is documented in the Lake Superior basin. The Renshaw Site deposits [dating to 4,590 ±50 B.P. (To-2213), 4,630 ±60 B.P. (To-2215) and 4,420 ±60 B.P. (To-2441)], plus AMS dating of organic materials, which were preserved in an Old Copper artifact from South Fowl Lake, demonstrate that Archaic technological traits appeared at least as early as 6,800 B.P. (Ross, personal communication 1998; Beukens *et al.* 1992). Julig (1994:171) and Dawson (1983a:19) document the recovery of Archaic side notched projectile points at the Cummins Site, and both comment upon the widespread coincidence of late Plano and early side notched points in the Great Lakes region. Hinshelwood (personal communication, 2001; see also this volume) also reports Archaic artifacts within the predominantly Plano deposits at DcJi-16 near Thunder Bay. Whether this suggests a technological transition between Plano and Archaic, or reoccupation of Plano sites by Shield Archaic, it is clear that Archaic influences were being felt in the southern Boreal Forest by 6,000 B.P.

The antiquity of the Wapekeka skeletal remains raises questions about their cultural affiliation and origin. Several writers (Wright 1972a; Bishop 1972:66; and Dawson 1983b:55) provisionally suggested that the more northerly parts of Ontario (specifically the Hudson Bay Lowlands) remained unoccupied until virtually the historic period. It was proposed that this was a result of its late emergence from the Tyrrell Sea and to the apparent unattractiveness of the Lowlands for human occupation. Research over the past 15 years in the lower Severn, Albany, and Winisk River drainage basins has negated this proposal, with the discovery of at least one late Shield Archaic and several Woodland archaeological sites (Reid 1988). The Archaic deposits from the Shamattawa Rapids site (GbIj-2) in the Winisk River system are radiocarbon dated to 3,920 ±180 B.P. (Beta-11642) and 2,360 ±100 B.P. (Beta-11641) (Lister 1988:76). Jean Luc Pilon's fieldwork along the lower Severn River yields archaeological deposits that span at least the last 2,000 years (Pilon 1987, 1988:102). Pat Julig's (1988) research in the lower Albany River region also indicates that a human presence in the far north is apparent at least as far back as the Archaic Period (3,000 to 5,000 B.P.). Finally, the Wapekeka human remains demonstrate the early occupation of the northern Severn Uplands nearly 7,000 years ago. No doubt the Hudson Bay Lowlands were utilized, at least seasonally, as soon as they emerged from the Tyrrell Sea.

Given this early human occupation of the Severn River headwaters within about 1,000 years of the drainage of Lake Agassiz, we need to re-evaluate the proposition that Shield Archaic emerged from late Northern Plano origins, whereupon it gradually radiated southeastward across the Canadian Shield. Given the difficulties associated with traversing the Lake Agassiz basin to reach Wapekeka by 7,000 years ago, we should seek a more parsimonious explanation. Throughout the late Plano period, Lakehead Complex hunters and gatherers were likely dispersed across the Severn Uplands between the major meltwater lakes. As this upland gradually expanded in the wake of continued ice retreat and subsidence of melt water, a continued northward radiation of hunting bands is probable. Such groups could have been a few hundred kilometres to the south of Wapekeka when Lake Agassiz abruptly drained after 8,000 B.P. They would have been in a good position to expand further northward to the shores of the Tyrrell Sea as soon as biotic recovery permitted. These groups likely experienced technological influence from Archaic groups who occupied the temperate forests to the south and east. Such influences are a much more probable explanation for the slow emergence of Shield Archaic.

If such a scenario is appropriate, then we should expect a widespread, albeit sparse, distribution of late Plano and early Archaic sites throughout the unflooded portions of the Severn Uplands. The current lack of such archaeological materials in this region is likely a function of the extremely limited extent of archaeological exploration to date. More to the point, most of the archaeological surveys that have been conducted in the region have focused on the current shorelines, and not the ancient ones that existed five to eight thousand years ago.

The ground stone gouge further adds to the intriguing nature of the Wapekeka burial site. Was it originally associated with the human burials and therefore, indicative of early development of ground stone technology, and/or stimulus diffusion of ideas from Laurentian or Maritime Archaic? Or, does it represent a co-incidental re-occupation of the site by Shield Archaic groups thousands of years after the human burials? Even this latter suggestion raises questions about extra-regional communication, and exchange between contemporaneous Archaic populations over enormous territories. Such widespread exchange networks are not consistent with the general interpretation of Shield Archaic. That is, it is viewed as being rather insular and conservative, and relatively uninfluenced by cultural developments occurring in the mixed wood forests far to the south (see for example Wright 1981; Dawson 1983b; and Fagan 2000:383-384). Clearly, however one chooses to interpret the disturbed deposits from Wapekeka, revision of Boreal Forest prehistory is required.

This is ultimately the great frustration of the archaeological research at Wapekeka. The site was discovered by an incredible coincidence of events, but had already suffered considerable damage before archaeological investigation. Given the circumstances of site discovery, we are left with only tantalizing hints of its important role in the initial peopling of far northern Ontario.

Acknowledgements

The archaeological investigations at the Wapekeka airstrip occurred primarily as a product of the sense of custodial responsibility expressed by the Wapekeka First Nation. The Ontario Ministry of Transportation and the federal Dept. of Indian and Northern Affairs are also to be commended for funding this emergency salvage in spite of jurisdictional uncertainties over heritage resource conservation on federal land. The efforts of John Lessard (INAC), and Louis Richard and Cam Brown (MTO) are particularly noteworthy. I also would like to express my gratitude to the local MTO crew at Wapekeka for allowing us to share their facilities, for much logistical assistance, and their patience with our sometimes eccentric behaviour. The Manitoba Historical Resources Branch kindly arranged the loan of a proton magnetometer, and has allowed publication of illustrations in the public education package that was developed as part of the salvage project.

The Ontario Heritage Foundation provided emergency funding through its Northern Initiatives program for radiocarbon dating. El Molto conducted the physical analysis of the human skeletal remains, Scott Fairgrieve and Brenda Kennedy carried out chemical analyses of the bone, and Joe Stewart and Andrew Hinshelwood volunteered for the late fall field trip in 1989. I also wish to thank the 1990 archaeological field crew (Jack Wolk, Paige Campbell, Sue Wilson, Louie G. Brown and Louie J. Brown). The crew did much hard physical labour during our brief field season, and maintained consistently high spirits as we were forced to constantly re-adjust our field methodology in light of what we learned about the site.

Finally, I wish to acknowledge the efforts of my collaborators (Theresa Schrober and Monica Webster) in the ongoing archaeometric analysis of the Wapekeka skeletal remains. Their expertise has greatly augmented the analysis, and promises to considerably further our understanding of Subarctic foodways.

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About the Editors

LAWRENCE J. JACKSON, Ph.D., is senior archaeologist with Northeastern Archaeological Associates, a consulting firm based in southern Ontario. His research specializes in the late glacial period of North and South America. Major publications include *The Sandy Ridge and Halstead Sites, Unifacial Tool Use and Gainey Phase Definition in South-Central Ontario*, University of Michigan Memoirs No 32, 1998, and *Reindeer and Caribou Hunters of the Northern Hemisphere*, Avebury Press, 1997, co-edited with Paul T. Thacker.

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